# TMC 231

# SLEEPERS & FASTENINGS

**Version 4.4**

**Issued August 2011**

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Engineering Manual

# Document control

| Revision | Date of Approval | Summary of change |
|---|---|---|
| 4.4 | August, 2011 | Changes detailed in Chapter Revisions |
| 4.3 | February, 2011 | C4-2 – includes requirements for expansion of ballast top openings; C6-1 Table 15 - Additional detail of approved Fastclip fastenings; App 3 Additional approved products |
| 4.2 | December, 2009 | Format change; Various - Changes to titles; C16-2 - Addition of Acceptance requirements |
| 4.1 | November, 2008 | Added limits to short sleeper ends and foot gauge in zero cant in Section C4-2; Changes to limits on proximity of heart pacemakers to track magnets in Section C17-4.1 and C17-4.2 – reduction from 3m to 500mm |
| 4.0 | May, 2008 | C4-2 - Changes to fastening configurations, C4-2 - Addition of boring requirements for fastenings; C6-1- Changes to fastening configurations; Appendix 3 - Addition of approved screwspikes |
| 3.0 | October, 2007 | Inclusion of reporting of defective components, change to approved use of recycled timber sleepers, change to use of low profile clips, Clarification of approved concrete sleeper repair process |
| 2.0 | April, 2007 | Additional reference; Correction of foot gauge acceptance measurements; Inclusion of spacing limits at bridge ends; Minor correction to approved fastenings; Inclusion of information on disposal of track magnets; Minor changes to approved products list |
| 1.0 | October,2006 | First issue as a RailCorp document. Includes content from TS 3341, RC 4801, CTN 01/06, CTN 02/04, CTN 04/06, CTN 04/17 |

## Summary of changes from previous version

| Chapter | Current Revision | Pages | Date of Approval | Summary of change |
|---|---|---|---|---|
| Control Pages | 4.4 | 5 | August, 2011 | Control changes |
| 1 | 2.1 | 1 | December, 2009 | |
| 2 | 2.1 | 1 | December, 2009 | |
| 3 | 1.2 | 1 | August, 2011 | Competencies updated to current National Competencies |
| 4 | 4.3 | 11 | February, 2011 | |
| 5 | 1.1 | 2 | December, 2009 | |
| 6 | 4.2 | 4 | February, 2011 | |
| 7 | 2.1 | 2 | December, 2009 | |
| 8 | 1.1 | 2 | December, 2009 | |
| 9 | 1.1 | 2 | December, 2009 | |
| 10 | 1.1 | 2 | December, 2009 | |
| 11 | 1.1 | 2 | December, 2009 | |
| 12 | 1.1 | 2 | December, 2009 | |

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| Chapter | Current Revision | Pages | Date of Approval | Summary of change |
|---|---|---|---|---|
| 13 | 1.1 | 1 | December, 2009 | |
| 14 | 2.1 | 22 | December, 2009 | |
| 15 | 1.1 | 3 | December, 2009 | |
| 16 | 1.1 | 12 | December, 2009 | |
| 17 | 2.2 | 10 | December, 2009 | |
| Appendix 1 | 1.1 | 4 | December, 2009 | |
| Appendix 2 | 1.1 | 1 | December, 2009 | |
| Appendix 3 | 3.2 | 6 | February, 2011 | |
| Appendix 4 | 2.1 | 1 | December, 2009 | |
| Appendix 5 | 1.1 | 1 | December, 2009 | |

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# Chapter 1 Introduction

## C1-1 Purpose

This manual provides requirements, processes and guidelines for the installation and maintenance of sleepers and sleeper fastenings.

## C1-2 Context

The manual is part of RailCorp's engineering standards and procedures publications. More specifically, it is part of the Civil Engineering suite that comprises standards, installation and maintenance manuals and specifications.

Manuals contain requirements, processes and guidelines for the management of track assets and for carrying out examination, construction, installation and maintenance activities.

The manual is written for the persons undertaking installation and maintenance activities.

It also contains management requirements for Civil Maintenance Engineers and Team Managers needing to know what they are required to do to manage sleeper installation and repair activities on their area, and production managers needing to know what they are required to do to manage the renewal activity their teams are undertaking.

## C1-3 How to read the Manual

The best way to find information in the manual is to look at the Table of Contents starting on page 4. Ask yourself what job you are doing? The Table of Contents is written to reflect work activities.

When you read the information, you will not need to refer to RailCorp Engineering standards. Any requirements from standards have been included in the sections of the manual and shown like this:

> *The following acceptance requirements are extracted from RailCorp Standard ESC 230*
>
> Treated sleepers are not approved for use.
>
> Recycled sleepers may be used in crossing loops and in sidings

Reference is however made to other Manuals.

## C1-4 References

### C1-4.1 Australian and International Standards

Nil

### C1-4.2 RailCorp Documents

ESC 210 – Track Geometry & Stability

ESC 220 – Rail System

ESC 230 – Sleepers and Track Support

ESC 240 – Ballast

ESC 362 – Track Slabs

ESC 250 – Turnouts and special Trackwork

TMC 001 – Civil Technical Competencies and Engineering Authority

TMC 203 – Track Inspection

TMC 211 – Track Geometry & Stability

SPC 231 – Timber Sleepers and Bearers

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# Chapter 2 Management Requirements

## C2-1 Reporting Defective Components

New or recently installed track components or tools are sometimes defective, or otherwise fail to meet specified requirements. In some circumstances it will be necessary to recall the product and take action with the supplier.

To ensure that appropriate investigation is undertaken and action is taken by field staff, engineering and logistics staff, follow the process below.

**Team member**

If you suspect that track components or tools that have been delivered to you are defective, report the defect to your Team Manager.

**Team Manager**

If you are notified by your field staff that potentially defective components or tools have been supplied:

1. Raise an NCR. (NCR Form attached as Appendix 5).
2. Conduct an assessment of the non-conforming product by inspection and, if practical, test sample at least 2-3 other such items from the same batch.

   This will help to determine the extent of the problem.
3. Forward the NCR to:

   Ilya Soyfer, Logistics Support Engineer in Track Services

   (phone 8922 1148 (2 1148)

   fax 8922 1154 (2 1154)

   email ilya.soyfer@railcorp.nsw.gov.au.
4. If there is any immediate concern, contact should be made by phone.
5. Track Services will investigate the failure and its implications and take other actions as required. This may include:
   - Quarantine all product to avoid installation
   - Allow installed product to remain in track under special conditions
   - Remove all product from track etc

   If this occurs official notification will be by the issue of a Civil Technical Note

# Chapter 3 Competencies

NOTE: These competencies may enable activities to be carried out in other manuals. For a comprehensive list of all activities that are covered by a given competency see Engineering Manual TMC 001 – Civil Technical Competencies and Engineering Authority.

| To carry out this work | You need these competencies |
|---|---|
| Remove and install sleepers | TLIS2031A - Install railway sleepers **AND** TLIS2034A - Install and repair rail fastening systems |
| Remove and install sleeper plates, pads and insulators | TLIS2031A - Install railway sleepers **AND** TLIS2034A - Install and repair rail fastening systems |
| Rebore and regauge sleepers | TLIB2101A - Install and maintain rail joints **AND** TLIS2034A - Install and repair rail fastening systems |
| Restore ballast profile after resleepering | TLIS2030A - Carry out track ballasting |
| Certify track during or after resleepering | TLIS2031A - Install railway sleepers **AND** TLIB3094A - Check and repair track geometry |

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# Chapter 4 Manual Resleepering

This chapter describes the methods used in RailCorp to install or remove sleepers using manual methods and minor plant and equipment.

There are two manual methods used to renew sleepers, the “Lift” and the “No Lift” method. The procedure for both these methods is described below:

## C4-1 Planning

1. Consider the key technical risks of undertaking resleepering work. This includes:
   - ~ Incorrect clip type shorting out insulated joints.
   - ~ Shorting out insulated joints (eg sleeper plates, fastening, scrap left behind).
   - ~ Trains tripping on high ballast.
   - ~ Ballast fouling points operation.
   - ~ Damage to trackside signal equipment (bondwire, potheads, train trip arms), from material placement or movement, sleeper insertion and removal equipment.
   - ~ Damage to train monitoring equipment (See RailCorp Engineering Manual TMC 211 – Track Geometry & Stability).
   - ~ Incorrect gauge after the work.
   - ~ Top, twist, line and/or superelevation defects after the work.
   - ~ Sleepers, ballast or equipment foul during work.
   - ~ Site obstructions.
   - ~ Sleeper spacing and skew.
   - ~ Fastenings, Sleeper plates.
   - ~ Ballast condition and profile.
   - ~ Sleeper support (packing) and fastenings.
   - ~ Track Stability especially during Summer Months. (See TMC 211)
2. Check the length of existing sleepers.

   If sleepers have been cut short to avoid an obstruction, arrange for removal of the obstruction, if possible. If it cannot be removed, check the available length

   *The following acceptance requirements are extracted from RailCorp Standard ESC 230.*

   **Proximity of plates to sleeper and bearer ends in turnouts**

   The outer end of sleeper plates shall, normally, be located no closer than 200mm to the end of timber sleepers or bearers. Civil Maintenance Engineers may approve a reduction to no less than 50mm in constrained situations at turnouts and special trackwork

   To determine acceptance, the CME shall consider the following:
   - ~ Increased probability of failure of lockspikes or screwspikes due to splitting.
   - ~ Reduced bearing of the sleeper or bearer leading to increased top degradation. To some extent this is offset by the increased ballast pressure from lateral confinement from the obstruction.

   At locations where short sleeper/bearer ends have been approved, the condition of the sleepers should be inspected during detailed walking and annual sleeper inspection to confirming that the timber is not prone to splitting and that the ballast support is adequate with good confinement laterally.

3. Check the quality of new sleepers.

   Are they marked as suitable for where you are going to install them?

   Are they in good condition? See Table 1, Table 2 and Table 3.

*The following acceptance requirements are extracted from RailCorp Standard ESC 230.*

## Timber sleepers

### Standard sleeper size

Dimensions and acceptance tolerances for timber sleepers shall be in accordance with the requirements of Table 1.

| | Dimension (mm) | Acceptance Tolerance (mm) |
|---|---|---|
| Length | 2 440 | + 50 - 0 |
| Width | 230 | + 10 - 0 |
| Depth | 130 | + 10 - 0 |

*Table 1 – Timber sleeper dimensions*

### Half sleeper size

The requirements for half sleepers for use in the City Tunnels shall be:

| | Dimension (mm) | Acceptance Tolerance (mm) |
|---|---|---|
| Length | 800 | + 50 - 0 |
| Width | 230 | + 10 - 0 |
| Depth | 130 | + 10 - 0 |
| Distance from the centre line of the rail to the end of the timber in either direction | Minimum 345 | NA |
| Distance from the end of the sleeper plate to the end of the sleeper | Minimum 90 | NA |

*Table 2 – Timber half sleeper dimensions*

*The following acceptance requirements are extracted from RailCorp Specification SPC 231.*

### Timber Sleeper Usage

Only use timber sleepers that have been marked on the end with a 25mm paint mark as shown in Table 3.

| | |
|---|---|
| Group 1 | 1 white dot |
| Group 2 | 1 red dot |

*Table 3 – Timber Acceptance marking*

*The following acceptance requirements are extracted from RailCorp Standard ESC 230.*

Treated sleepers are not approved for use.

Recycled timber sleepers (ie sleepers that have previously been used in track) may not be used on main lines with the following exception:

- Sleepers are fitted with resilient plates,
- Sleepers have been assessed as having a minimum remaining life of 5 years at the new location,
- The connection between the plates and the sleeper is sound with no evidence of plate movement.

Recycled sleepers may be used in crossing loops and in sidings

4. Are the new sleepers bored with the correct sleeper boring pattern for the location and the sleeper plates being used? See Table 11 and Figure 1 and Figure 2.

5. Identify sleepers to be removed.

   If traffic will operate over the track before the resleepering is completed, plan the work so that the track will remain tied in accordance with the operating limits in TMC 203 – Track Inspection. DO NOT unfasten and remove more sleepers than can be tied in the available time.

   If the work is being carried in summer months, restrictions apply to the spacing between sleepers that can be removed unless written authority is provided by the Civil Maintenance Engineer. The "Work in Summer Months" Instructions are detailed in TMC 211.

## C4-2 Lift method

1. Remove sleeper fastenings and anchors.

   Place sleeper fastenings and anchors clear of the track and stack them so that they are ready for re-use or removal from site. Leaving them near or on the track will interfere with the resleepering process and may result in them being "buried" in the track.

2. Remove shoulder ballast from the end of the sleeper.

   Dig sleeper end ballast clear through to the edge of the shoulder and loosen ballast along sleeper sides for easy removal.

3. Install jacks under the rail.

4. Jack up the rail.

   ~ BE extremely careful when lifting the track with jacks.

   ~ DON'T lift the track higher than is absolutely necessary.

   ~ DON'T lift the track between 1st November and 31st March, unless written instructions are issued to do so by the Civil Maintenance Engineer. (See TMC 211).

   ~ DON'T lower the jacks without warning other staff.

   ~ DON'T leave jacks in place and unattended.

5. Remove sleeper plates.

   Place sleeper plates clear of the track and stack them so that they are ready for re-use or removal from site. Leaving them near or on the track will interfere with the resleepering process and may result in them being "buried" in the track.

   Check sleeper plates to determine if they can be re-used by following the procedures in Chapter 11. Stack re-usable and scrap sleeper plates separately and secure scrap plates so that they will not be re-used by mistake.

6. Remove sleeper/s.

   You may be able to remove more than one sleeper with one lift.

   ~ Remove the sleeper with sleeper tongs.

   ~ Place it clear of the track and stack sleepers for disposal.

   During removal DO NOT disturb the track geometry.

7. Clean and loosen bed.

   ~ Loosen the sleeper bed with a pick.

   ~ Excavate to at least 50mm larger than replacement tie dimensions. Smooth the bed beyond the shoulder, free of obstructions sufficient to allow for free drainage to cess or six-foot drain.

8. Install new sleeper.

   ~ Lay the sleepers, heart centre down.

~ Push the new sleeper into place.

~ Minimise disturbance to rail geometry.

9. Check the location of new sleeper for spacing and skew (See Table 4).

*Sleepers shall be spaced in accordance with the requirements of Table 4 which have been extracted from RailCorp standard ESC 230 - Sleepers and Track Support.*

| Operating Class | Sleeper Spacing (mm) | Tolerance (spacing or skew) (mm) (Note 1) | Tolerance Limit/ m |
|---|---|---|---|
| Timber | | | |
| ALL Track (mainline & sidings) | 600(Note 3) | ± 20(Note 2) | 10/6 (±50mm) |
| | | | |
| ALL Track (mainline & sidings) | 600 | ± 20(Note 2) | 10/6 (±50mm) |
| | | | |
| <25T Axle load | 720 | ± 20 | 11/7.920 (±60mm) |
| 25T | 650 | ± 20 | 16/11 (±80mm) |
| 30T | 600 | ± 20 | 10/6 (±50mm) |

*Table 4 - Sleeper spacing in plain track*

Note 1 Installation tolerance for new or face resleepering of track sections.
2. Up to 50mm for spacing to allow for missing an aluminothermic weld (only over two sleepers).
3. Except at rail joints (See Table 5).

**Spacing at rail joints**

Spacing of sleepers at rail joints in plain ballasted track shall be adjusted in accordance with Table 5.

| Rail (Kg/m) | Design Spacing (mm) | Acceptance Tolerance (mm) |
|---|---|---|
| | | |
| 60 Insulated (mechanical) | 430 | ± 20 |
| 53 Insulated (mechanical) | 430 | ± 20 |
| 53 Mechanical | 510 | ± 20 |
| Glued Insulated Joints (any rail size) | 600 | ± 20 |
| All Others | 510 | ± 20 |
| | | |
| Glued Insulated Joints (any rail size) | 600 | ± 20 |

*Table 5 - Sleeper spacing at joints*

**Spacing at bridge ends**

Spacing of rail support (sleepers, abutment and transoms) at transom topped bridge ends shall be adjusted in accordance with Table 6.

| Operating Class | Design Spacing (mm) | Acceptance Tolerance (mm) |
|---|---|---|
| All classes – New bridge structures | 600 | ± 20 |
| All classes – Existing bridge structures | 600 preferred but will accept up to 900 | ± 20 |

*Table 6 - Sleeper spacing at bridge ends*

Space the sleepers evenly. Move adjacent sleepers if practical. It may even be necessary to install extra sleepers or remove sleepers if the required spacing cannot be maintained.

10. Replace the sleeper plate.
    - ~ Apply sleeper plates so that the rail leans towards the track centre.
    - ~ Position the plate so that all holes in sleeper are visible through the holes in the plate.
11. Lower the rails and remove the jacks.
12. Check Gauge

*The following construction/renewal acceptance limits for gauge are extracted from RailCorp Standard ESC 210*

| | **Main line (mm)** | **Sidings (mm)** |
|---|---|---|
| Gauge | ±4 | ±6 |

*Table 7 - Construction Acceptance limits for gauge*

*The following maintenance acceptance limits for gauge are extracted from RailCorp Standard ESC 210*

| **Gauge** | | **Main line (mm)** | **Sidings (mm)** |
|---|---|---|---|
| Variation to design gauge (normal 1435) | Wide | 5 | 5 |
| | Tight (including head flow) | 5 | 5 |
| | | Limiting tight gauge 1430mm | |
| Variation in 1m (due to rail wear) | | 2 | 2 |
| maximum deviation at a discontinuity (eg a joint) | | 1 | 1 |

*Table 8 - Maintenance Acceptance limits for gauge*

Where gauge widening has been applied on curves by design, the limit applies to the widened design gauge

Rail play is not permitted except small amounts arising from construction tolerances (eg 1mm between insulator and foot of rail)

Work shall be carried out to correct “foot gauge” ± 5mm

| **Cant** | | **Rail Size (kg/m** | | | |
|---|---|---|---|---|---|
| | | **47** | **50** | **53** | **60** |
| | | 1390 | 1391 | 1373 | 1374 |
| | | 1379 | 1379 | 1360 | 1360 |

*Table 9 – Foot Gauge*

Civil Maintenance Engineers may authorise the following limited variations:

- ~ Correction of wide gauge on curve worn rail by tightening the “foot gauge.
- ~ Greater than 5mm tight gauge where rail flow is present.

Gauge must not exceed the BOS limits in Engineering Manual TMC 203 - Track Inspection, without appropriate protective action.

The maximum deviation at a discontinuity such as at a joint (“foul joint”) shall be in accordance with Table 8. Particular care is required to ensure that new joints cut into the track have matching profiles at the gauge face and running surface.

13. Bore holes in the sleeper (if required)

    Sleeper boring requirements are detailed in Table 10, Table 11 and Figure 1 and Figure 2.

Maintain a consistent sleeper boring pattern with adjacent sleepers.

*The following standard boring patterns have been extracted from RailCorp standard ESC 230 - Sleepers and Track Support.*

**Boring requirements in timber sleepers, transoms and bearers**

Sleepers and transoms shall be bored to match the sleeper plates used in the approved configuration. The patterns for DF 30 sleeper plates using dogspikes, lockspikes, dogscrews and lockscrews are detailed below.

Hole sizes shall be as detailed in Table 10. Holes shall be bored completely through the timber.

| | | |
|---|---|---|
| Dogspikes | | 21 ± 0.5 |
| Lockspikes | | 16 ± 0.5 |
| Dogscrews | | 17 ± 0.5 |
| Lockscrews | | 14 ± 0.5 |
| Screwspikes | 27 mm dia | 25 ± 0.5 |
| | 24 mm dia | 18 ± 0.5 |
| | 22 mm dia | 18 ± 0.5 |

*Table 10 – Fastening hole diameters*

**Sleeper Boring Patterns**

| Rail Section | Plate Cat No. | A (mm) | B (mm) | Comment |
|---|---|---|---|---|
| 53 kg | DF 30 New Pattern | 1348 | 171 | Lockspike and dogspike arrangement is a mirrored and inverted image of Old Pattern |

*Table 11 – Sleeper Boring patterns*

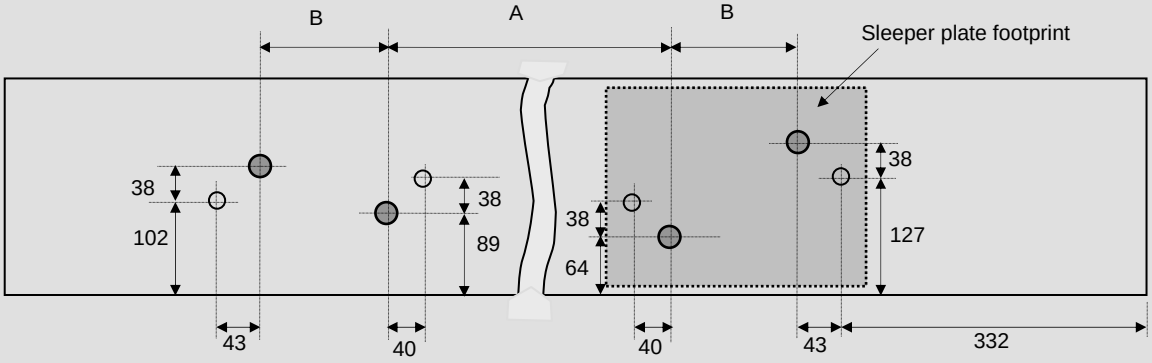


*Figure 1 - 53 kg NEW pattern boring details*

21mm dia dogspike hole OR
17mm dia dogscrew hole

16mm dia lockspike hole OR
14mm dia lockscrew hole

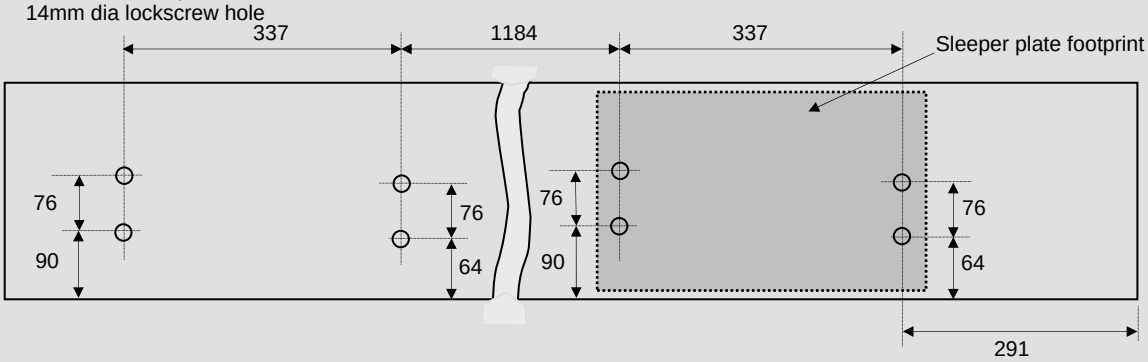


*Figure 2 - Boring pattern for Pandrol for 53 & 60kg/m rail*

14. Reinstall fastenings.

*The acceptance requirements for fastenings are detailed in the following extract from RailCorp standard ESC 230 - Sleepers and Track Support.*

**Fastenings for timber sleepers**

Standard configurations of fastening assemblies for timber sleepers, bridge transoms and turnout bearers are detailed in Table 12.

| Operating Class | | Fastening Type No. per Plate/ Rail | Sleeper Plates Dwg. No. | Lockspikes (Note 2) No per Plate |
|---|---|---|---|---|
| **Non Resilient (for existing installations ONLY)** | | | | |
| **Main Lines** (includes sleepers, transoms Note 5 and bearers) | | | | |
| Passenger Main Line | | 2 Dogspikes (Note 1) | DF 30 | 2 |
| Mixed Passenger Freight Main Line | | | | |
| Light Line | | | | |
| **Sidings** (includes sleepers, transoms and bearers) | | | | |
| General Yard | | 2 Dogspikes (Note 1) | DF 30 | 2 |
| Passenger operations/ or maintenance | | | | |
| Passenger Siding | | | | |
| Engineering Maintenance Siding | | 2 Dogspikes (Note 1) | NIL | NIL |
| | | | | |
| | | | | |
| ALL classes | | 2 Resilient E2003 | DF 62 & cast plates | 4 |
| ALL classes | For existing installations ONLY. CANNOT be re-installed when sleeper is replaced | 2 Resilient E1853 | Reformed plates | 2 lockspikes + 2 Gauge lockspikes (or approved alternatives) (Note 3) |
| Turnouts in ALL classes | | 2 Resilient | Appropriate baseplates | 4 |
| Transoms in ALL classes | | 2 Resilient E2003 | DF 62 & cast plates | 4 |
| | | 2 Resilient | Type ISP95098 plates | 4 X 24mm screw spikes (Note 4) |
| Insulated Joints in ALL classes | | Low profile clips e1627 (timber) | DF 62 | 4 |
| | | | | |
| ALL classes | | 2 Resilient E2003 | DF 62 | 4 |
| ALL classes | | 2 Resilient | | 2 X 24mm screw spikes (Note 4) |
| ALL classes | For existing installations ONLY CANNOT be re-installed when sleeper is replaced | 2 Resilient E1853 | Reformed plates | 2 lockspikes + 2 Gauge lockspikes (or approved alternatives) (Note 3) |
| Turnouts in ALL classes | | 2 Resilient | | 4 (Note 5) |

*Table 12 - Timber sleeper fastening configuration*

Note 1 Round shank dogspikes or approved alternative fastenings may be used.
2 Lockspikes (L6) or approved alternative fastenings may be used.
3 Gauge lockspikes are approved for existing installations only and are no longer in use.
4 If plates have 6 holes use additional holes where conditions warrant.

- ~ Install dogspikes square to the rail, vertical and flush on the rail foot.
- ~ Install lockspikes with hole parallel to rail, driven so that a distance of 0-5mm exists between head and plate.
- ~ If dogscrews and lockscrews are being used, follow the installation instructions in Chapter 10.
- ~ If sleepers are being replaced at insulated joints and resilient fastenings are being used, make sure that low profile clips are used. (See Chapter 7).
- ~ If transoms are being replaced on bridges and resilient fastenings are being used, make sure that zero toe load clips are used where required. (See Chapter 8).
- ~ DO NOT overdrive elastic fastenings (clips). Refer to Chapter 6 for installation instructions.
- ~ Renew any 'sprung" or overdriven clips.

15. Reinstall anchors in non resilient fastened track.

*The requirements for anchors are detailed in the following extract from RailCorp standard ESC 220 - Rail System.*

Welded track shall meet the following minimum anchoring requirements.

- Double (or box) anchor every fourth sleeper except at mechanical joints
- Double anchor every second sleeper for a distance of 32 sleepers either side of mechanical joints, starting at the second sleeper from the joint.
- Basic anchoring is to be so that sleepers are anchored on both sides on each rail (double or box anchor), except for steep grades as detailed below.
- On track with a falling grade steeper than 1 in 80 in the direction of traffic, or at other locations where considered necessary to control rail creep, the anchoring shall be increased by adding single anchoring each second sleeper (or on every sleeper, if necessary) throughout the welded rail length, to prevent rail creep.

**Insulated Joints in Welded Track**

- At mechanical insulated joints EVERY sleeper is to be double anchored for a distance of 32 sleepers on each side of the joint.
- Bonded Insulated Joints are treated as if they were plain track, and anchored in the same pattern as the track in which they are placed (eg 1 in 4 when laid in 110m rails or CWR, or every 2nd if within 32 sleepers of a turnout).

*The requirements for anchors in turnouts are detailed in the following extract from RailCorp standard ESC 250 - Turnouts and Special Trackwork.*

**Turnouts**

- Double anchor every second sleeper for 32 sleepers (ie a total of 16 anchored sleepers) in front of the switch, commencing from the first sleeper from the switch.
- Double anchor every second sleeper/timber for 32 sleepers/timbers (ie a total of 16 anchored sleepers/timbers) behind the crossing, commencing from the first timber after the crossing that has plain track fastenings.
- Double anchor every second timber on the through rails and turnout rails between the heel of the switch and the front legs of the crossing.

**Diamonds**

- Double anchor every second sleeper/timber for 32 sleepers/timbers (ie a total of 16 anchored sleepers/timbers) behind the crossing, commencing from the first timber after the crossing that has plain track fastenings.
- Double anchor every second timber between the "V" and "K" crossings.

**Catchpoints:**

- Double anchor the catchpoint rail every second sleeper for 32 sleepers (ie a total of 16 anchored sleepers) in front of the switch, commencing from the first sleeper from the switch.
- Double anchor the catchpoint rail every second sleeper/timber for 32 sleepers/timbers (ie a total of 16 anchored sleepers/timbers) behind the heel commencing from the first timber after the heel that has plain track fastenings.

*The requirements are detailed in the following extract from RailCorp standard ESC 220 - Rail System.*

**Anchoring of Welded Track on Bridges**

**Transom top openings with spans <18m**

- Standard anchoring for welded rails on open track as detailed in above shall be used on welded rails on these bridges.

**Transom top openings with spans ≥18m long but < 80m.**

- For a distance of 60m from a bridge end, the track shall be double anchored on every second sleeper.
- On the bridge the track shall be double anchored to every second transom for half the span length, commencing at the fixed end.

**Transom top or Ballast top openings with spans ≥80m**

- Between expansion switches the rails are to be double anchored to every fourth transom.

**Ballast top openings**

- Standard anchoring for welded rails on open track as detailed above shall be used on welded rails on Ballast Top openings with spans <40m in length.
- For Ballast Top openings with spans ≥40m in length the requirements for expansion of the rails and the ballast must be considered.

    ~ Install anchors flush against the side of the sleepers.

    ~ If the existing anchor pattern is more extensive than the requirements above, check with the Civil Maintenance Engineer to determine if the extra anchors need to be re-installed.

    ~ Renew any ‘sprung” or overdriven anchors.

16. Lift, pack and line track, using the methods described in RailCorp Engineering Manual TMC 211 – Track Geometry & Stability.

    ~ Pack each sleeper tight up to the base of the rail.

    ~ Pack the sleepers uniformly and evenly under the rail and at least 200mm either side of the rail, NOT in the centre or at the ends.

17. Measure and record geometry.
18. Restore ballast profile.

    ~ Make sure you restore the standard ballast profile. See Table 13.

*The construction and maintenance acceptance limits detailed in Table 13 are extracted from RailCorp Standard ESC 240- Ballast.*

| Operating Class | Ballast shoulder width (mm) | | | |
|---|---|---|---|---|
| | Design | | Acceptance | |
| | Minimum | Maximum | Minimum | Maximum |
| **Main line** | | | | |
| CWR and LWR | 400 | 700 | 390 | 700 |
| **Siding** | | | | |
| CWR and LWR | 400 | 700 | 390 | 700 |
| Loose Rail | 300 | 700 | 290 | 700 |

*Table 13 - Ballast shoulder width design and acceptance limits*

19. Check the worksite.
    - ~ Do not block drainage systems with old sleepers, fastenings or plates.
    - ~ Stack all used material neatly where it is not in the way.
20. Certify track.
    - ~ Certify the track using the procedure in TMC 211.
    - ~ If work has not been completed and sleepers are left untied, assess whether a speed restriction is required using the operating limits in TMC 203.
    - ~ If sleepers have not been packed, or geometry has not been corrected, apply appropriate restrictions in accordance with the operating limits in TMC 203.

## C4-3 The “NO lift” method (Boodling)

This process is basically the same as the lift method except that the track is not lifted with jacks. This method reduces the disturbance to track stability.

1. Remove fastening/anchors.
2. Remove shoulder ballast from end of sleeper.
3. Remove the ballast and dig a trench next to the sleeper to be removed.
4. Remove sleeper plates.
5. Push the old sleeper into the trench without lifting the rail.
6. Remove the sleeper.
    - ~ Remove the sleeper with sleeper tongs.
    - ~ Place it clear of the track and stack sleepers for disposal.

    During removal DO NOT disturb the track geometry.
7. Clean and loosen bed.
8. Install new sleeper.
9. Check the location of new sleeper for spacing and skew. (see Acceptance limits in Section C4-2 Item 9).
10. Replace sleeper plate.
11. Check gauge (see Acceptance limits in Section C4-2 Item 12).
12. Bore holes in the sleeper (if required).
13. Reinstall fastenings (see fastening requirements in Section C4-2 Item 14).
    - ~ If dogscrews and lockscrews are being used, follow the installation instructions in Chapter 10.
    - ~ If sleepers are being replaced at insulated joints and resilient fastenings are being used, make sure that low profile clips are used. (See Chapter 7).

- ~ If transoms are being replaced on bridges and resilient fastenings are being used, make sure that zero toe load clips are used where required. (See Chapter 8).
- ~ DO NOT overdrive elastic fastenings (clips). Refer to Chapter 6 for installation instructions.
- ~ Renew any ‘sprung” or overdriven clips.

14. Reinstall anchors in non resilient fastened track (see anchoring requirements in Section C4-2 Item 15).
    - ~ Install anchors flush against the side of the sleepers.
    - ~ If the existing anchor pattern is more extensive than the requirements above, check with the Civil Maintenance Engineer to determine if the extra anchors need to be re-installed.
    - ~ Renew any ‘sprung” or overdriven clips and anchors.
15. Pack sleepers using the methods described in RailCorp Engineering Manual TMC 211 – Track Geometry & Stability.
    - ~ Pack each sleeper tight to rail.
    - ~ Pack the sleepers uniformly and evenly under the rail and at least 200mm either side of the rail, NOT in the centre or at the ends.
16. Measure and record geometry.
17. Restore ballast profile (see acceptance limits in Section C4-2 Item 18).
18. Check worksite.
    - ~ Do not block drainage systems with old sleepers, fastenings or plates.
    - ~ Stack all used materials neatly where it is not in the way.
19. Certify track.
    - ~ Certify the track using the procedure in TMC 211.
    - ~ If work has not been completed and sleepers are left untied assess, whether a speed restriction is required using the operating limits in TMC 203.
    - ~ If sleepers have not been packed, or geometry has not been corrected apply appropriate restrictions in accordance with the operating limits in TMC 203.

# Chapter 5 Replacing defective fastenings on timber sleepers

This chapter describes the methods used in RailCorp to replace sleeper plates and fastenings and crossbore timber sleepers.

## C5-1 Planning

1. Consider the key technical risks of undertaking the work. This includes:
   - ~ Incorrect clip type shorting out insulated joints.
   - ~ Shorting out insulated joints (eg sleeper plates, fastening, scrap left behind).
   - ~ Trains tripping on high ballast.
   - ~ Ballast fouling points operation.
   - ~ Damage to trackside signal equipment (Bondwire, potheads, train trip arms), from material placement or movement.
   - ~ Damage to train monitoring equipment (See See RailCorp Engineering Manual TMC 211 – Track Geometry & Stability).
   - ~ Incorrect gauge after the work.
   - ~ Ballast or equipment foul during work.
   - ~ Site obstructions.
   - ~ Fastenings, Sleeper plates.
   - ~ Ballast condition and profile.
   - ~ Sleeper support (packing) and fastenings.
   - ~ Track Stability especially during Summer Months. (See TMC 211).
2. Identify Fastenings and/or sleeper plates to be replaced.

   If traffic will operate over the track before the work is completed, plan the work so that the track will remain tied in accordance with the operating limits in TMC 203 – Track Inspection. DO NOT unfasten more sleepers than can be tied in the available time.

   If the work is being carried in summer months, restrictions apply to the spacing between fastenings that can be removed unless written authority is provided by the Civil Maintenance Engineer. The "Work in Summer Months" Instructions are detailed in TMC 211.

## C5-2 Replacing fastenings

1. Remove excess ballast from sleepers.
2. Remove fastenings/anchors.

   Place fastenings clear of the track and stack them so that they are ready for re-use or removal from site. Leaving them near or on the track will interfere with the resleepering process and may result in them being "buried" in the track.
3. Install Jacks (where required).
4. Jack up rail (where required).
   - ~ BE extremely careful when lifting the track with jacks.
   - ~ DON’T lift the track higher than is absolutely necessary.
   - ~ DON’T lift the track between 1st November and 31st March, unless written instructions are issued to do so by the Civil Maintenance Engineer. (See TMC 211).
   - ~ DON’T lower the jacks without warning other staff.
   - ~ DON’T leave jacks in place and unattended.
5. Remove sleeper plates.

   Place sleeper plates clear of the track and stack them so that they are ready for re-use or

removal from site. Leaving them near or on the track will interfere with the resleepering process and may result in them being "buried" in the track.

6. Install new sleeper plate
   - ~ If the sleeper plates are ‘second-hand’ check the plates to determine if they can be re-used by following the procedures in Chapter 11.
   - ~ Apply sleeper plates so that the rail leans towards the track centre.
   - ~ Position the plate so that all holes in sleeper are visible through the holes in the plate.
7. Remove Jacks (where used).
8. Establish correct rail gauge (see Acceptance limits in Section C4-2 Item 12).
9. Drill spare holes on sleeper to match sleeper plate.
10. Re-install existing (or new) fastenings (see fastening requirements in Section C4-2 Item 14).
    - ~ If dogscrews and lockscrews are being used, follow the installation instructions in Chapter 10.
    - ~ If sleepers are being replaced at insulated joints and resilient fastenings are being used, make sure that low profile clips are used. (See Chapter 7).
    - ~ If transoms are being replaced on bridges and resilient fastenings are being used, make sure that zero toe load clips are used where required. (See Chapter 8).
    - ~ DO NOT overdrive elastic fastenings (clips). Refer to Chapter 6 for installation instructions.
    - ~ Renew any ‘sprung” or overdriven clips.
11. Reinstall anchors in non resilient fastened track (see anchoring requirements in Section C4-2 Item 15).
    - ~ Install anchors flush against the side of the sleepers.
    - ~ If the existing anchor pattern is more extensive than the requirements above, check with the Civil Maintenance Engineer to determine if the extra anchors need to be re-installed.
    - ~ Renew any ‘sprung” or overdriven anchors.
12. Lift, pack and line track (if required) using the methods described in TMC 211.
    - ~ Pack each sleeper tight to the rail.
    - ~ Pack the sleepers uniformly and evenly under the rail and at least 200mm either side of the rail, NOT in the centre or at the ends.
13. Measure and record geometry.
14. Restore ballast profile (if required) (see acceptance limits in Section C4-2 Item 18).
    - ~ Make sure you restore the standard ballast profile.
15. Check the worksite.
    - ~ Do not block drainage systems with old sleepers, fastenings or plates.
    - ~ Stack all used material neatly where it is not in the way.
16. Certify track.
    - ~ Certify the track using the procedure in TMC 211.
    - ~ If work has not been completed and sleepers are left untied assess, whether a speed restriction is required using the operating limits in TMC 203.
    - ~ If sleepers have not been packed, or geometry has not been corrected apply appropriate restrictions in accordance with the operating limits in TMC 203.

# Chapter 6 Use of "Pandrol" type resilient fastenings

## C6-1 Selection of fastenings

Use the correct Pandrol resilient clips for the sleeper and sleeper plate type.

*The following requirements are extracted from RailCorp standard ESC 230.*

**Fastenings for timber sleepers and bearers**

Standard configurations of fastening assemblies for timber sleepers and turnout bearers are detailed in Table 14.

| Operating Class | | Fastening Type No. per Plate/ Rail | Sleeper Plates Dwg. No. | Lockspikes (Note 2) No per Plate |
|---|---|---|---|---|
| **Resilient** | | | | |
| **Main Lines** | | | | |
| ALL classes | | 2 Resilient E2003 | DF 62 & cast plates | 4 |
| ALL classes | For existing installations ONLY CANNOT be re-installed when sleeper is replaced | 2 Resilient E1853 | Reformed plates | 2 lockspikes + 2 Gauge lockspikes (or approved alternatives) (Note 3) |
| Turnouts in ALL classes | | 2 Resilient | Appropriate baseplates | 4 (Note 5) |
| Transoms in ALL classes | | 2 Resilient E2003 | DF 62 & cast plates | 4 |
| | | 2 Resilient | Type ISP95098 plates | 4 X 24mm screw spikes (Note 4) |
| Insulated Joints in ALL classes | | Low profile clips e1627 (timber) | DF 62 | 4 |
| **Sidings** | | | | |
| ALL classes | | 2 Resilient E2003 | DF 62 | 4 |
| ALL classes | For existing installations ONLY CANNOT be re-installed when sleeper is replaced | 2 Resilient E1853 | Reformed plates | 2 lockspikes + 2 Gauge lockspikes (or approved alternatives) (Note 3) |
| Turnouts in ALL classes | | 2 Resilient | | 4 (Note 5) |

*Table 14 - Timber sleeper fastening configuration*

Note 2 Lockspikes (L6) or approved alternative fastenings may be used.
3. Gauge lockspikes are approved for existing installations only and are no longer in use.
4 In electrified or track circuited areas, where one of the spikes would cause shorting to the underframe of a steel underbridge, 3 (three) screw spikes per plate may be used on curves ≥300m radius, preferably with the two screw spikes on the gauge side of the rail.
5 If plates have 6 holes use additional holes where conditions warrant.

**Fastenings for Concrete Sleepers and bearers**

Conforming fastening systems shall use Pandrol E-2003 clips, Fastclip or other approved alternatives. Rail pads of nominal thickness 5mm shall be used.

Rail pads of nominal 7.5mm thickness for E-clip fastenings and 10mm thickness for Fastclip fastenings shall be used.

Resilient fastenings are interchangeable for 53 and 60kg rail sections.

Standard configurations of fastening assemblies for concrete sleepers and turnout bearers are detailed in Table 15.

| Sleeper Design | Fastening Type No. per Plate/ Rail |
|---|---|
| Type 4 | 2 Resilient E2003 |
| Type 5 Heavy Duty | 2 Resilient E2003 or 2 Fastclip FC1507 |
| Medium Duty (Low Profile) | 2 Resilient E2003 or 2 Fastclip FC1507 |
| Type 6M Heavy Duty | 2 Resilient E2003 |
| Insulated Joints on all concrete sleepers/bearers with cast in shoulders and insulating material | Low profile clips e1629 or Fastclip FC1507 |
| Insulated Joints on all concrete bearers with baseplates | Low profile clips e1627 |

*Table 15 - Concrete sleeper fastening configuration*

**Fastenings for Slab Track**

Elastic fastening systems shall be used with Slab track.

Approved configurations of fastening assemblies for slab track are detailed in Table 16.

| Operating Class | Fastening Type No. per Plate/ Rail | Base Plates Dwg. No. | Comments |
|---|---|---|---|
| ESR & City Railway | 2 Resilient PR409 | DF 62 | 2 Screwspikes minimum in curves ≥300m radius<br>4 Screwspikes in curves <300m radius |

*Table 16 - Slab track fastening configuration*

Where baseplates are used the minimum requirement is:

- curves < 300m radius- four screwspikes (two on each side).
- curves ≥ 300m radius -two screwspikes (one on each side).
- On slab track where screwspikes are used they shall be fitted with helical spring washers.

## C6-2 Identification of fastenings

To identify the fastenings, look for the marking on the end of the clip. The markings form a code that identifies the clip type and year of manufacture.

The coding system used to identify clips is shown in Figure 3, Table 17 and Table 18.

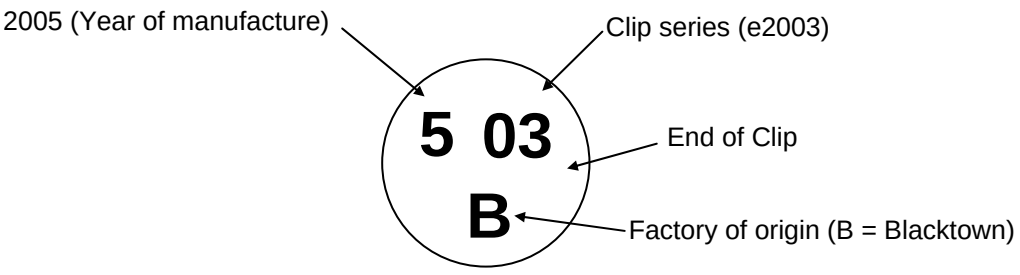


*Figure 3 - Clip Identification*

| Use | Type | Code |
|---|---|---|
| General use on timber sleepered track and no insulation pad using BHP.DF62 plate - also timbered turnouts. | e2003 | 03 |
| General use on ESR & City Railway using BHP.DF62 plate and insulation pad. | PR409 | NIL |
| General use on concrete sleepers | e2003 | 03 |
| General use on 53kg timber sleepered track using reformed plate | e1853 | LA |
| Low profile clips for use at Insulated Joints on timber sleepers and on concrete bearers with baseplates (Red/Brown colour, round non flattened toe) | e1627 | |
| Low profile clips for use at Insulated Joints on concrete sleepers/bearers with cast in shoulders and insulating material (blue colour, flattened toe area) normal and reverse application possible | e1629 | |

*Table 17 - Selection of pandrol fastenings*

The Year of Manufacture Identification Code is shown in Table 18:

| | | | |
|---|---|---|---|
| 1983 - A | 1989 - H | 1995 - N | 2001 - W |
| 1984 - B | 1990 - I | 1996 - O | 2002 - X |
| 1985 - C | 1991 - J | 1997 - P | 2003 - Y |
| 1986 - D | 1992 - K | 1998 - S | 2004 - Z |
| 1987 - F | 1993 - L | 1999 - T | 2005 - 5 |
| 1988 - G | 1994 - M | 2000 - V | 2006 - 6 |

*Table 18 - Year of Manufacture Identification Code*

*Figure 4 – e2003 clip*

## C6-3 Installation procedure

1. Install resilient fastenings fully home into their fittings or housings, using the method appropriate to the type of fastening.

2. If a special tool is necessary to fit and/or remove the fastenings, DO NOT fit or remove them without using the tool.
3. DO NOT overdrive fastenings. Limits are shown in Figure 5 and Figure 6.
4. DO NOT overstress resilient fastenings by lifting rail vertically off the sleeper plate with the fastenings in place, or by levering upward between the toe of the fastening and the foot of the rail.
5. Remove fastenings completely when adjusting rail fitted with resilient fastenings . DO NOT try to pull rail through resilient fastenings.
6. Where wrap round insulated rail pads are fitted, lift the rail free from the pad to allow unimpeded longitudinal movement of the rail lengths for adjustment.

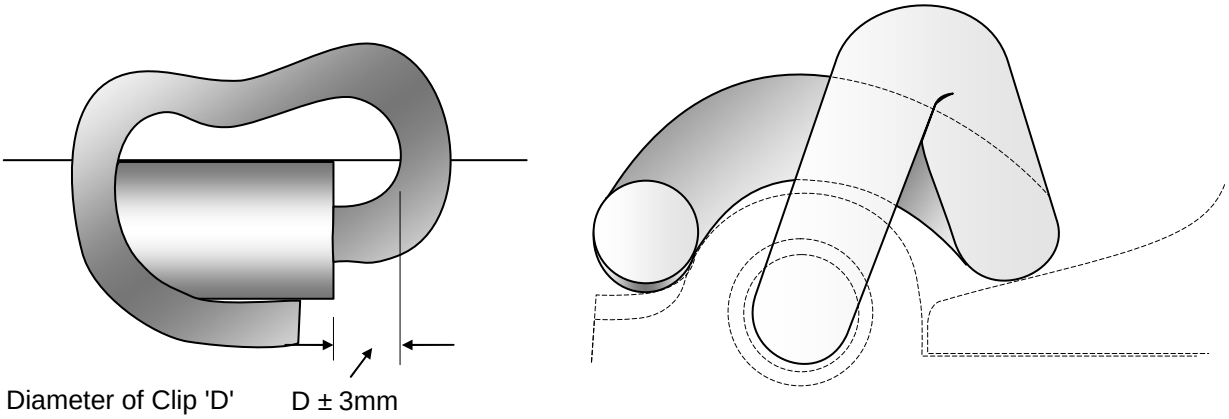


*Figure 5 - Installation of PR type Pandrol clips*

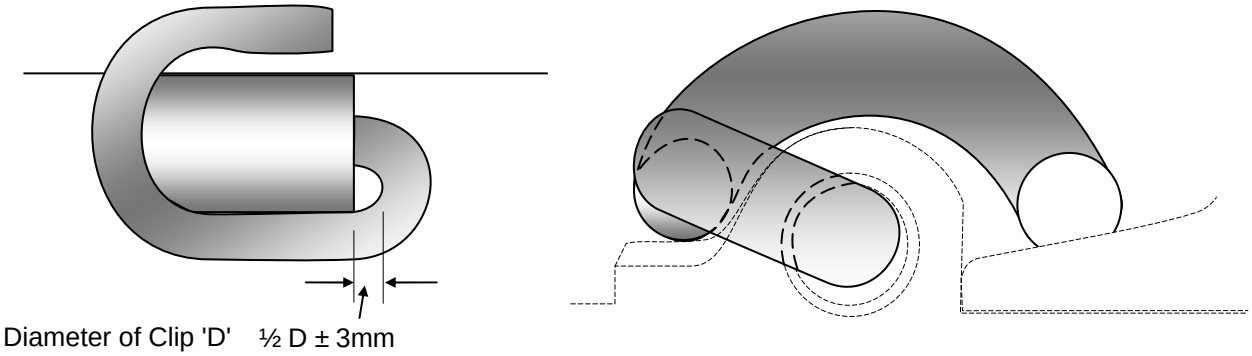


*Figure 6 - Installation of 'e' series Pandrol clips*

# Chapter 7 Installing Pandrol E clips at insulated joints

Special low profile Pandrol E clips are available for use at insulated joints.

The clips are designed to be clear of bolts and plates but have a lower toe load than normal clips.

The main advantage of the low profile clips is that, when installed properly, they rest clear of the fishbolts, removing the need to remove the 2nd and 5th bolts.

There two types of clips. The clips can be identified by material diameter, colour when new and clip toe area shape. (See Table 19 and Figure 7 below.)

| Clip Number | Clip Colour | Useage | Special Features |
|---|---|---|---|
| 'e'1627 | RED | Timber sleepers and concrete bearers with baseplates | 16 mm Dia |
| 'e'1629 | BLUE | Concrete sleepers/bearers with cast in shoulders and insulating material | 16 mm Dia with clip toe area flattened. |

*Table 19 – Low profile Pandrol E clips*

Install the clips in the standard manner. Make sure that there is no contact between fishbolts and the clip. (See Figure 8, Figure 9 and Figure 10.)

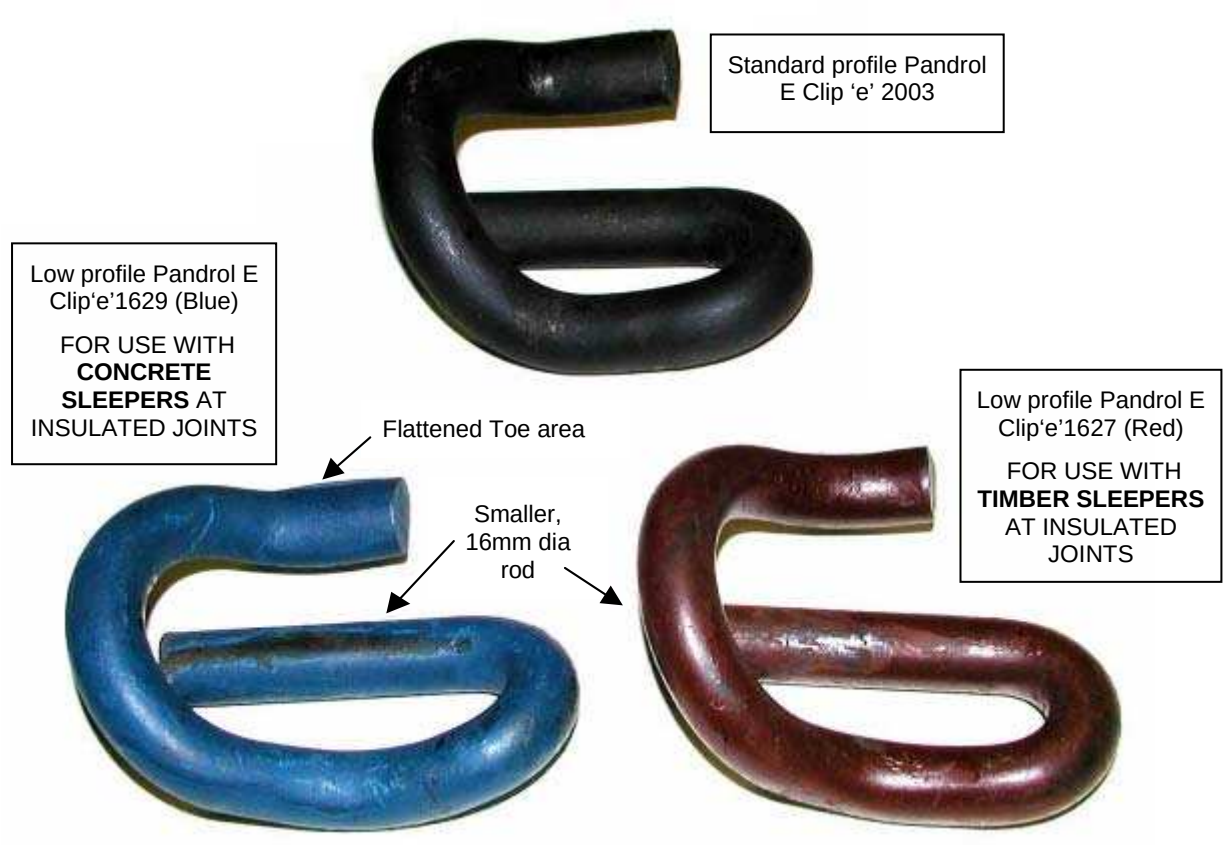
Standard profile Pandrol E Clip 'e' 2003
Low profile Pandrol E Clip'e'1629 (Blue)
FOR USE WITH **CONCRETE SLEEPERS** AT INSULATED JOINTS
Flattened Toe area
Smaller, 16mm dia rod
Low profile Pandrol E Clip'e'1627 (Red)
FOR USE WITH **TIMBER SLEEPERS** AT INSULATED JOINTS

*Figure 7 - Low profile Pandrol E clips*

**Warning!!**

**Clearances are compromised with the low profile clips in timber bearers with baseplates type PZ 147 and Type I baseplates. These are the ones with the pressed steel lugs forming the clip housing. Clips which may become foul of bolts or plates should be left off.**

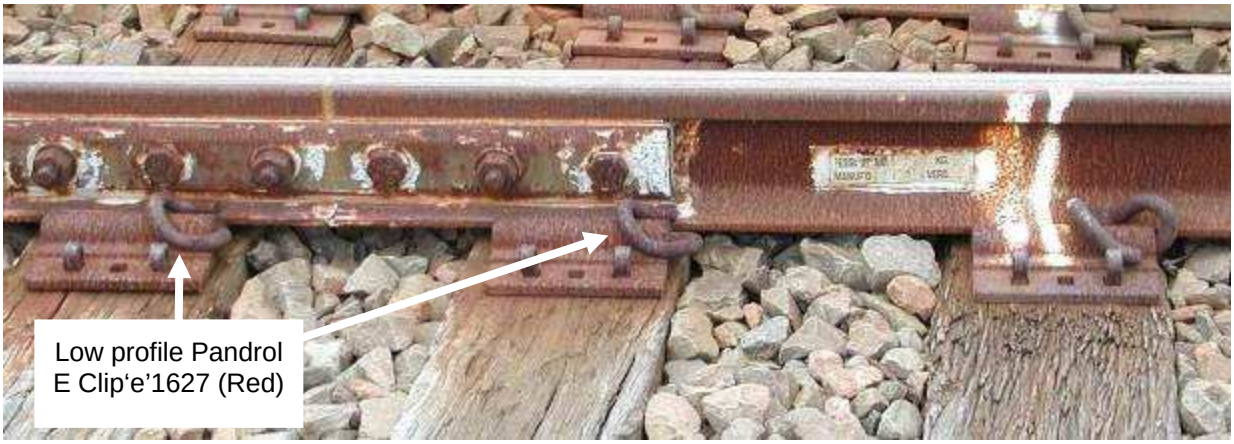


*Figure 8 - Low profile clips in use*

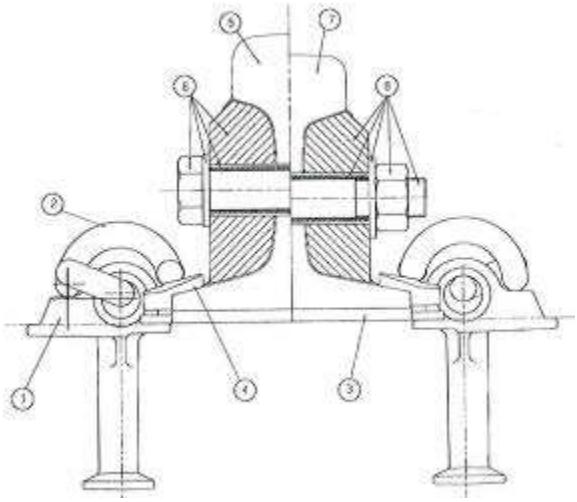

*Figure 9 - ‘e’ Clip joint bar assembly to suit AS53kg / AS60kg rail with ‘e’1629 Clip on Concrete Sleepers*

*(Courtesy PANDROL AUSTRALIA)*

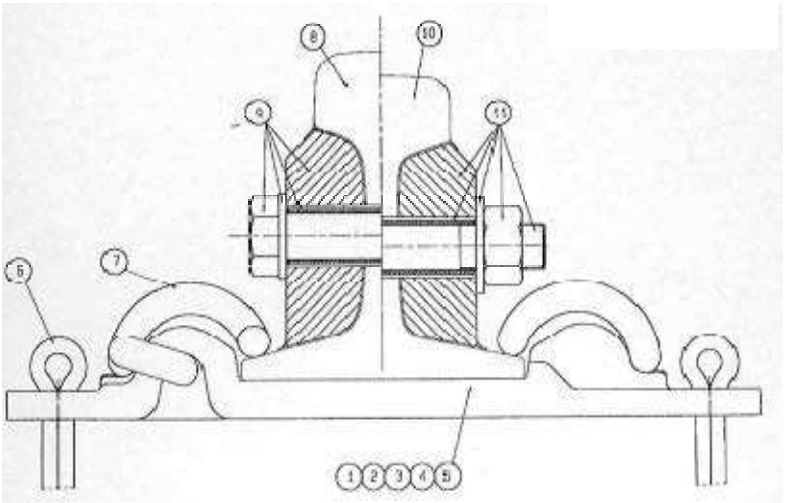

*Figure 10 - ‘e’ Clip joint bar assembly to suit AS53kg / AS60kg rail with ‘e’1627 Clip on Timber Sleepers*

*(Courtesy PANDROL AUSTRALIA)*

# Chapter 8 Installing resilient fastenings on bridges

Install resilient fastenings on bridges as follows:

*The following requirements have been extracted from RailCorp standard ESC 220.*

**Resilient fastenings on bridges**

**Transom top openings with spans less than 18m (centre of bearings)**

On bridges where elastic fastenings are installed, normal elastic fastenings shall be installed on the entire length of each span.

**Transom top openings with one or more spans 18m long and greater, but less than 80m.**

On bridges where elastic fastenings are installed, normal elastic fastenings shall be installed on one third of the span from the fixed end and Zero Toe Load fastenings installed on the remaining two thirds of the span (see Figure 11). Where spans are located on curves <400m radius, Zero Toe Load fastenings cannot be used without approval from the Chief Engineer Track.

Provision shall be made for play at the movable end of a bridge for the guard rail "V" to expand and contract (depending on length). This can be achieved when using MDFC concrete termination sleepers by setting the lock-in shoulders 6mm clear of the nose end rail. Zero Toe Load fastenings are used to secure the guardrail nose ends, allowing limited vertical movement.

**Bridges with expansion switches**

On bridges where elastic fastenings are installed, normal elastic fastenings shall be installed on the entire length of each span.

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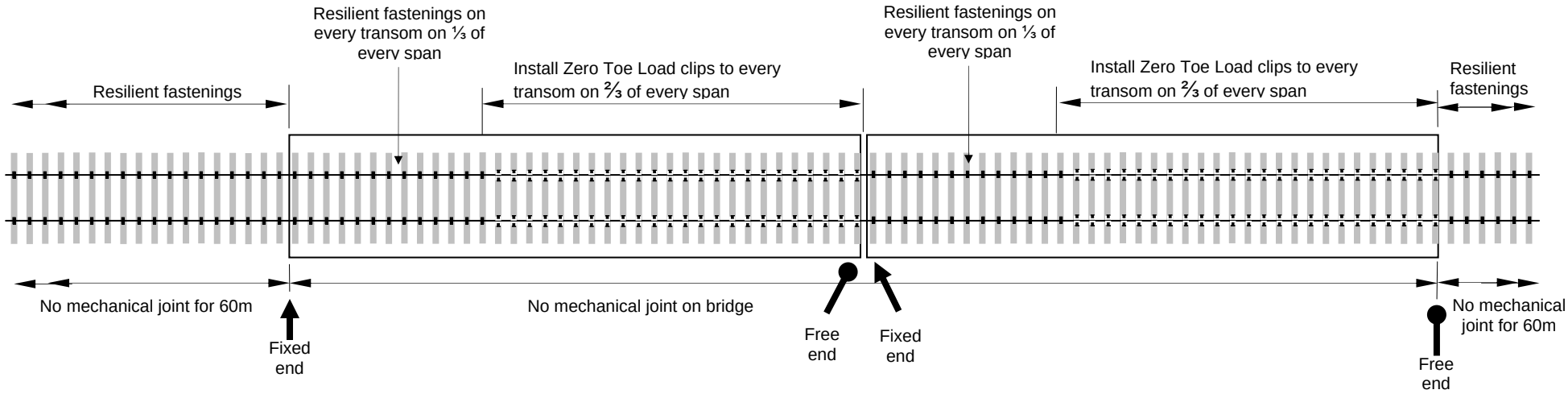
Resilient fastenings on every transom on ⅓ of every span
Resilient fastenings on every transom on ⅓ of every span
Resilient fastenings
Install Zero Toe Load clips to every transom on ⅔ of every span
Install Zero Toe Load clips to every transom on ⅔ of every span
Resilient fastenings
No mechanical joint for 60m
No mechanical joint on bridge
No mechanical joint for 60m
Fixed end
Free end
Fixed end
Free end

**Spans ≥ 18m but <80m**

*Figure 11 - Resilient fastenings on transom top bridges*

# Chapter 9 Installing 'Fastclip' fastenings

## C9-1 Identification of fastenings

To identify the fastenings, look for the marking on the end of the clip. The markings form a code that identifies the clip type and year of manufacture.

The coding system used to identify clips is shown in Figure 12, Table 20and Table 21.

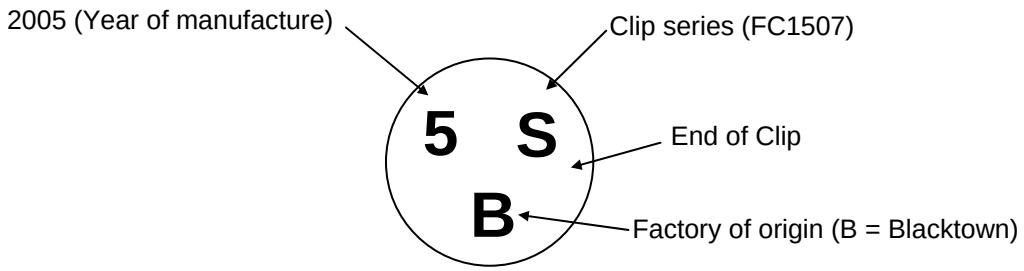


*Figure 12 - Clip Identification*

| Use | Type | Code |
|---|---|---|
| Fastclip – general use with concrete sleepers (including at insulated joints) - normally supplied with the toe insulator attached | FC1507 | S |

*Table 20 - Selection of pandrol fastenings*

The Year of Manufacture Identification Code is shown in Table 18:

| | | |
|---|---|---|
| 1998 - S | 2001 - W | 2004 - Z |
| 1999 - T | 2002 - X | 2005 - 5 |
| 2000 - V | 2003 - Y | 2006 - 6 |

*Table 21 - Year of Manufacture Identification Code*

*Figure 13 - Fastclip FC 1507 (with insulator attached R)*

## C9-2 Installation

Use the Pandrol Fastclip "Track Installation Guide" supplied by Pandrol Australia to install "Fastclip" sleepers.

Some key points from the guide include:

1. Special tools and equipment are needed for manual or mechanised installation.
2. Install sleepers on a good level ballast bed so that most sleepers directly support the rail.
3. If there is a gap between the rail seat and the sleeper, lift the sleeper up against the rail seat before it can be clipped up. (Tools are available to facilitate this).
4. There are RailCorp approved methods available for replacing cast-in shoulders and welding on replacement shoulders. These are detailed in Chapter 14 and Chapter 15.
5. Check ballast regulator blades to ensure that they will not hit the fastening assembly (the Fastclip assembly is wider than conventional Pandrol clips and shoulders).

   The blade needs to be cut out to give a clear area, 80mm above the rail seat and 135mm either side of the rail centre line (see Figure 14).

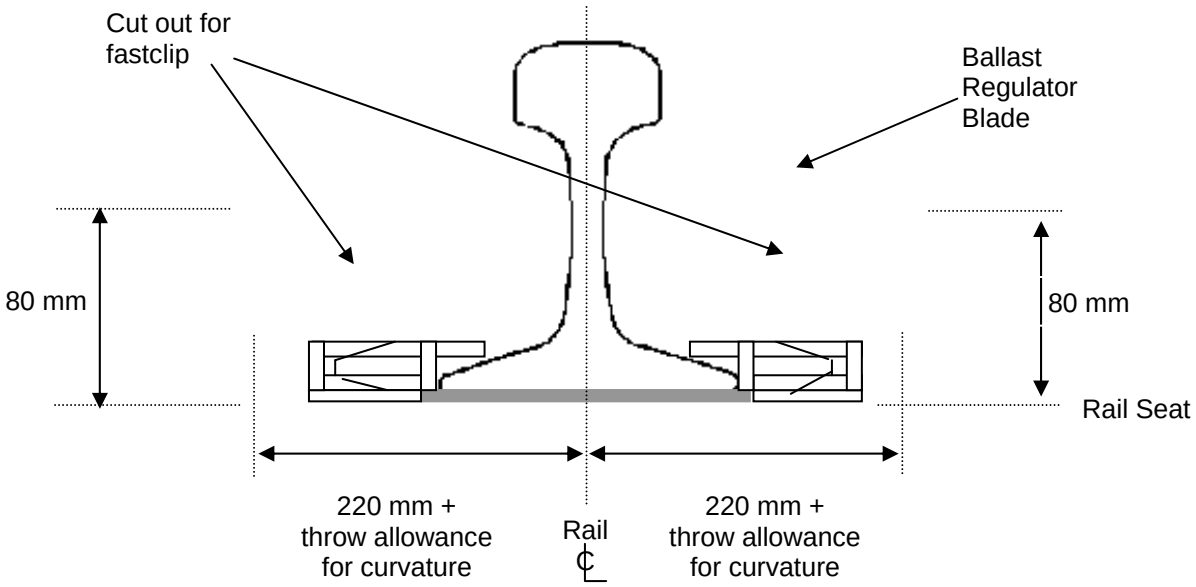


*Figure 14 - Ballast regulator blade cut out details for Fastclip fastenings*

An allowance needs to be added to the cut-out to account for the throw of the regulator blade arising from curvature of the track. This will be different for different regulator designs.

Note: there will also be a difference in the cut-out required for different rail sizes. If the blade is set up for 60kg/m rail an additional 13mm will need to be cut out to allow for its use with 53kg/m rail.

# Chapter 10 Installing and removing dogscrews and lockscrews

## C10-1 Identifying dogscrews and lockscrews

### C10-1.1 Dogscrew

The dogscrew is an alternative fastener to the dogspike.

The dogscrew consists of a 19mm threaded shank with a 22mm shoulder below the flange. On top of the flange is a 6-lob head designed to fit an E24 drive socket.

The dogscrew provides greater vertical holding force than the dogspike.

*Figure 15 - Dogscrew*

### C10-1.2 Lockscrew

The lockscrew can be used instead of lockspikes. The lockscrew consists of a 16mm threaded shank with a flange and 6-lob head, the same as the dogscrew.

There are two types of lockscrew:

**Small flange** – for general use.

*Figure 16 – Small flange lockscrew*

**Large flange** – for use with the automatic magnet pickup machine used by production gangs. This type cannot be used on rolled Pandrol plates because of the flange interferes with the rolled shoulder and does not sit flush on the plate.

*Figure 17 – Large flange lockscrew*

The lockscrew provides similar cross-sectional strength to the lockspike.

**Advantages and disadvantages**

The benefits of using the dogscrew/lockscrew include:

- The dogscrew/lockscrew uses a screwing action for insertion reducing potential injuries from flying objects and swinging of hammers.
- The dogscrew has greater vertical holding power and should remain tight for a longer time in comparison to a dogspike.
- The dogscrew/lockscrew only requires to be placed upright in the hole before screwing-in where as the standing of a dogspike requires tapping in.
- The dogscrew/lockscrew is galvanised for longer life.

The disadvantages are:

- Sleeper boring hole sizes are different to dog/lockspikes and care will be required when ordering prebored sleepers. The dogscrew has a 17mm diameter bored hole (21mm for dogspike) and 14mm diameter hole for the lockscrew (16mm lockspike).
- Additional equipment is required to insert and remove these screws.

## C10-2 Installation

Bore a 17mm diameter hole in the sleeper for a dogscrew and a 14mm diameter hole for the lockscrew.

DO NOT insert dogscrews or lockscrews in prebored dogspike or lockspike holes.

Place the dogscrew or lockscrew vertically in the bored hole (hammering or twisting should not be required). Place the E24 drive socket on the 6-lob head and rotate clockwise until the flange touches the rail or baseplate. As a guide, between 150 and 300Nm of torque is required.

A standard ¾ inch or 19mm Hex socket will fit the E24 head and can be used if the correct socket is not available, however it is unlikely to last as long as the correct fitting socket.

## C10-3 Removal

Place the E24 drive socket over the screw head and rotate anticlockwise to remove. The E24 socket has a 1/2inch female drive, a ½ to ¾ inch adaptor may be required to fit existing drive equipment.

If the head has been damaged (eg derailment), an extractor tool is available that grips the outer edge of the flange and when rotated will unscrew the dogscrew.

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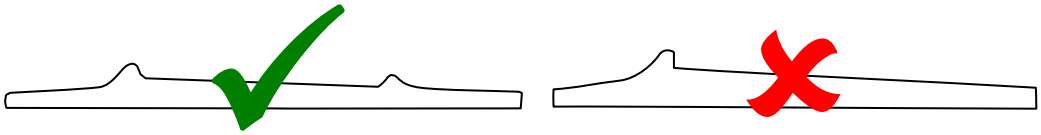
# Chapter 11 Use of reclaimed sleeper plates

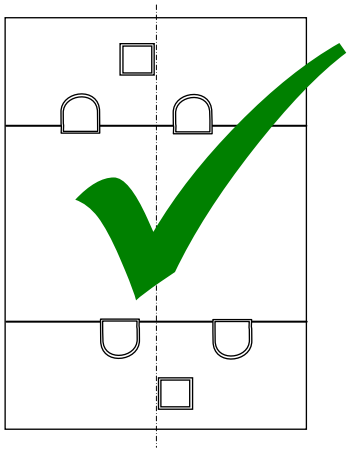
Reclaimed sleeper plates MUST meet the following requirements for acceptance and re-use on RailCorp's track (main line and sidings).

## C11-1 Sleeper plates with dogspike holes

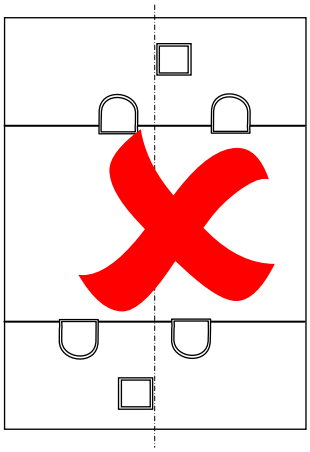
1. Only double shouldered sleeper plates may be re-used.



2. Only New pattern sleeper plates may be re-used.



In **NEW** pattern plates the lockspike hole is on the **RIGHT** of the centreline of the plate

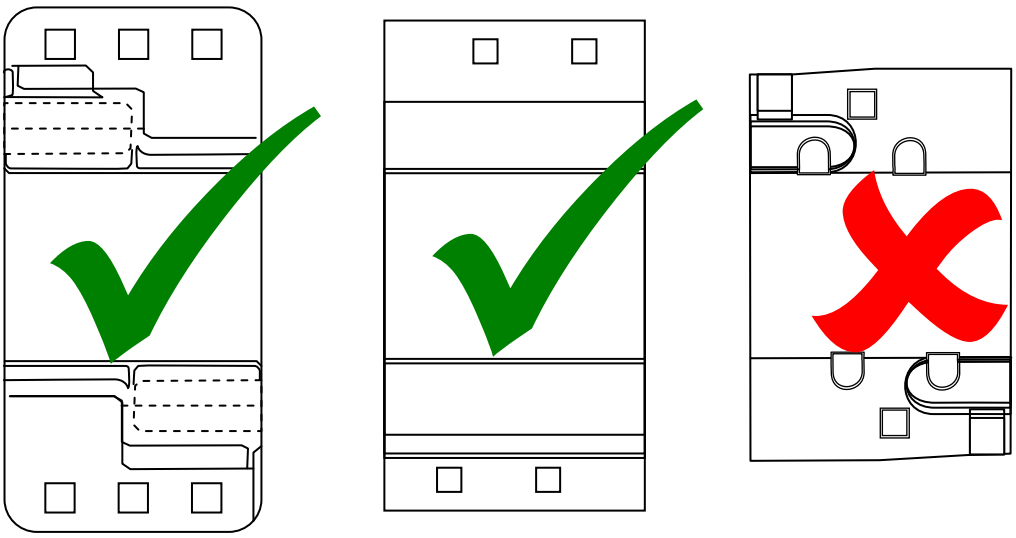


In **OLD** pattern plates the lockspike hole is on the **LEFT** of the centreline of the plate

3. DO NOT use any sleeper plates with evidence of excessive corrosion, notch marks or oxyacetylene burn marks.
4. Check that the plate at a distance of 30 mm from the edge where the rail foot on the rail gauge side contacts the plate, is not cracked.
5. This is the location where bending moment is highest and the plate section is relatively thin.
6. Use a straight edge to check that plate underside concavity, convexity or unevenness is not greater than 1mm.
7. Use a Go NoGo gauge to check for the following dimensions.
   - ~ The lockspike holes shall be no wider than 19 mm at bottom surface.
   - ~ The dosgspike holes shall be no wider than 25.5 mm at bottom surface.
   - ~ The rail seat width shall be no greater than =150 mm.

## C11-2 Sleeper plates for Pandrol fastenings

1. DO NOT use reformed plates.
2. DO NOT use any sleeper plates with evidence of excessive corrosion, notch marks or oxyacetylene burn marks.



3. Check that the plate at a distance of 30 mm from the edge where the rail foot on the rail gauge side contacts the plate, is not cracked.
4. This is the location where bending moment is highest and the plate section is relatively thin.
5. Use a straight edge to check that plate underside concavity, convexity or unevenness is not greater than 1mm.
6. Use a Go - NoGo gauge to check for the following dimensions:
   - ~ The lockspike holes shall be no wider than 19 mm at bottom surface.
   - ~ The rail seat width shall be no greater than 149.5 mm.

# Chapter 12 Track Laying with Track Laying Machine

This chapter describes the methods used in RailCorp to lay concrete sleepered track using the Track Laying Machine (TLM).

The track laying operation can be undertaken in two ways:

**Construction mode:** in which new sleepers are laid on a clean ballast bed. This mode is used either when constructing new track or when existing track has been completely removed for formation reconditioning.

**Relay mode:** in which the track laying machine removes the old sleepers as well as installing new concrete sleepers.

1. Track removal

   In “Construction Mode” remove track either by unfastening and removing components or by removing track panels.

   In “Relay Mode” remove dogspikes or resilient fastenings. DO NOT remove lockspikes and sleeper plates. DO NOT remove sleepers from the ballast bed.

2. Preparation for track laying

   In “Construction Mode” the ballast bed is prepared in accordance with the requirements for Track Reconditioning

3. Preparing the rail

   DO NOT prepare more than 220m ahead of the TLM.

   In “Construction Mode” if old rail is to be reused:

   ~ cut the rail into 220m lengths,

   ~ bore the back 2 holes,

   ~ lay out the rails on the ballast bed ahead of the TLM.

   In “Relay Mode”

   ~ DO NOT remove the rails from the timber sleepers.

   ~ If new rail is to be used lay out the rails ahead of the TLM along the centre of the timber sleepers.

4. Survey control and guide wire

   Set up the guide wire for the TLM on star pickets placed by reference to survey marks. The locations are checked by survey staff.

5. TLM “cut in”.

   “Cut in” the TLM using a temporary panel of timber sleepers (9m long). Use either the “fixed point” or “wrap around” methods of rail connection (as appropriate).

6. Track laying

   Once “cut in”, the TLM lays concrete sleepers. During “Relay Mode” the TLM removes the timber sleepers from the ballast bed simultaneously while laying concrete sleepers.

7. Rail pad placement

   Place rail pads in the rail seat area of the concrete sleepers before the placement of the rails.

8. Fastening distribution

   Layout fastenings on the skeleton track from the jewellery wagon or manual methods as appropriate.

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9. Clipping up

   Set up fastenings manually prior to clipping up.

   Fasten the rail to the sleepers using hand tools or mechanised clipping machines as appropriate.

10. TLM “cut out”

    When the TLM reaches the “cut out” point, “cut out” the TLM using the “fixed point” method of rail connection unless otherwise required.

# Chapter 13 Storing timber sleepers

When new sleepers are received into stock and are not required for immediate use, stack them heartwood down on old sleepers in order to keep them off the ground and free from the effects of moisture and, possibly, white ants. Sleeper stacks generally contain 10 in every row so that the number of sleepers can be easily counted if required.

# Chapter 14 Replacing Fastclip cast-in shoulders

The following method of replacing cast in shoulders is approved for use in RailCorp.

In the event of the FASTCLIP shoulder being damaged, possibly due to accidental collision by ballast regulators or tamping machines, the following procedures can be adopted to repair sleepers in track.

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Remove all detachable components from the shoulder (housing), including the side post insulator at the rail foot. The rail pad can remain in place.

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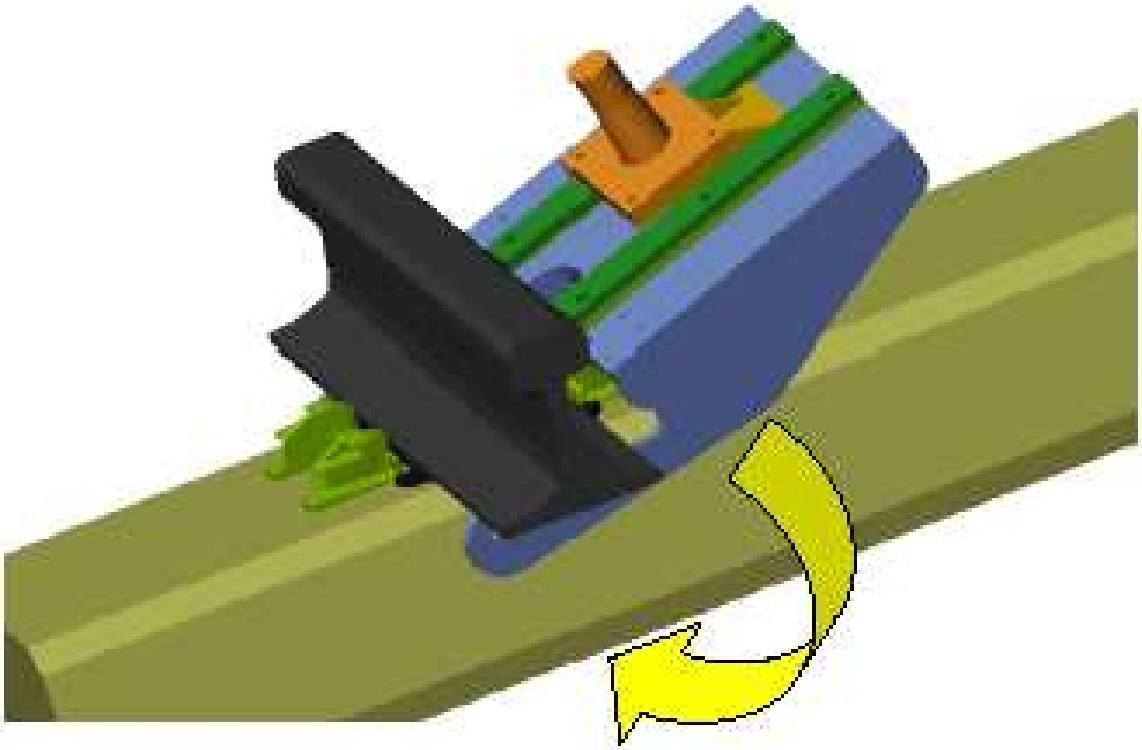

Mount the drilling baseplate over the broken shoulder, locating the two legs under the rail foot.

Ballast may have to be removed from the crib and around the sleeper to gain access.

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Ensure the two leg end hooks are located around the rail foot.

Also ensure the frame is hard up against the underside of the rail foot.

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Mount the drilling pillar to the tapered spigot.

Using the locking pin and handle, rotate

to secure the pillar into position.

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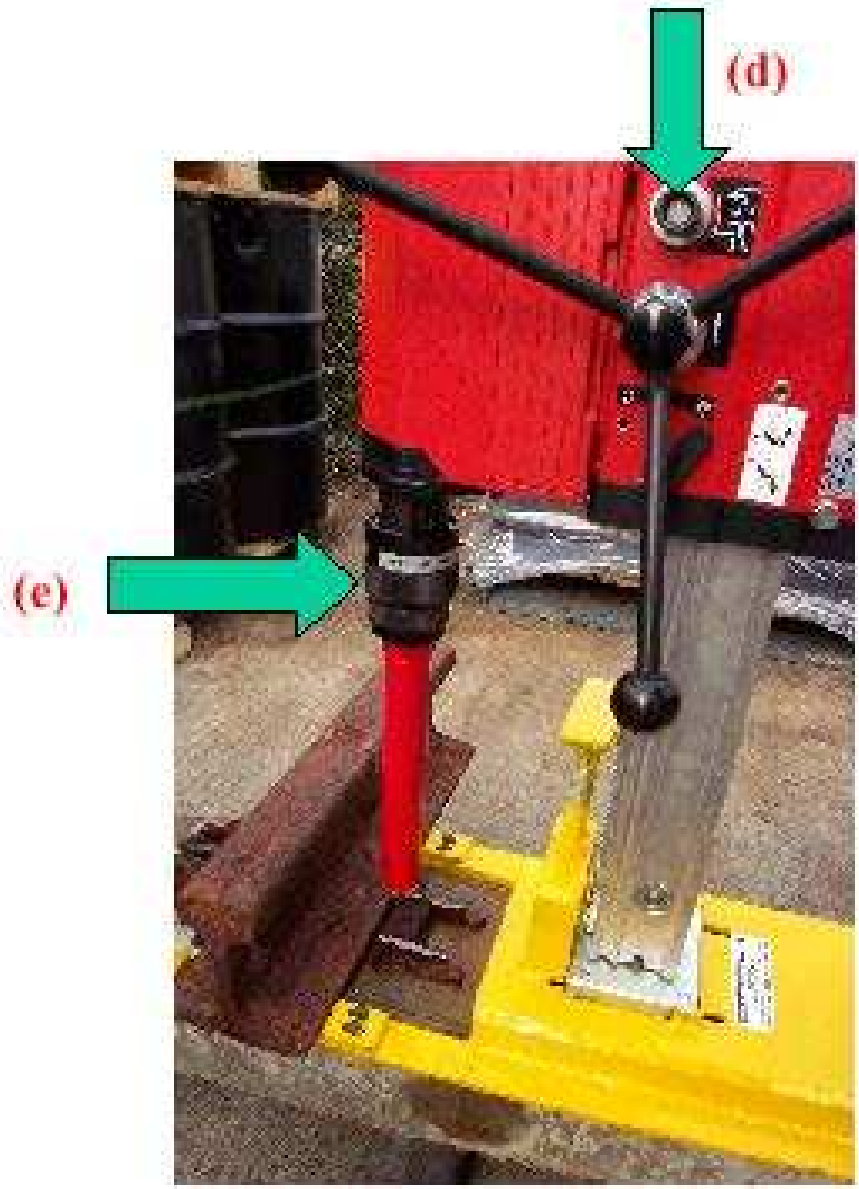


The drill head is fitted to the pillar and locked in place at (d).

The core drill barrel is inserted in the chuck and locked by turning the outer ring (e).

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Mount the water canister holding rig on the foot of the rail adjacent to the drill rig.Connect the drill unit to a suitable generator and the water hose to the canister. Water is used to cool the drilling operation and wash away waste concrete slurry. With the feed handle attached to the drill the unit is ready for operation.

The drill speed is set to 1800 rev/min. Apply a steady hand feed during drilling, the operator can feel the resistance pressure required as the drill cuts trough first the casting, then concrete. The operator can detect when the base of the shoulder is reached and the core breaks free.

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On completion of drilling the drill unit and base can be removed, either in one unit or taken apart in sections. The photograph above shows the resulting hole and core which encircles the shoulder stem. Inspect core to ensure that no prestressing wires have been cut.

9

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Using a hammer and chisel the sides of the broken shoulder can be removed (ensure there is no damage done to the foot of the rail). This leaves an impression in the concrete sleeper top (footprint), providing an ideal location or datum for the replacement shoulder. This footprint position ensures the correct rail seat dimension is maintained.

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Again using a hammer and chisel score the inside face of the hole at several positions. This provides a rough surface for the grout to key. Once this is complete clean and dry the hole and footprint area ensuring no debris is present which may prevent accurate location of the replacement shoulder.

11

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The replacement shoulder can now be inserted and the fit checked.

Note.

The base of the shoulder stem will require machining or grinding reducing the overall length by 3 mm. This ensures a correct fit at the bottom of the hole and allows grout to flow around the base of the stem.

The clip and toe insulator can be pre-installed to the post insulator change position and fitted with the shoulder.

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The three part epoxy grout (see specification sheet) can now be mixed at the correct proportions and poured into the hole. Fill the hole to approximately 20 mm from the surface. This allows sufficient to fill the cavity once the shoulder stem is fitted, without creating excessive over spill or waste.

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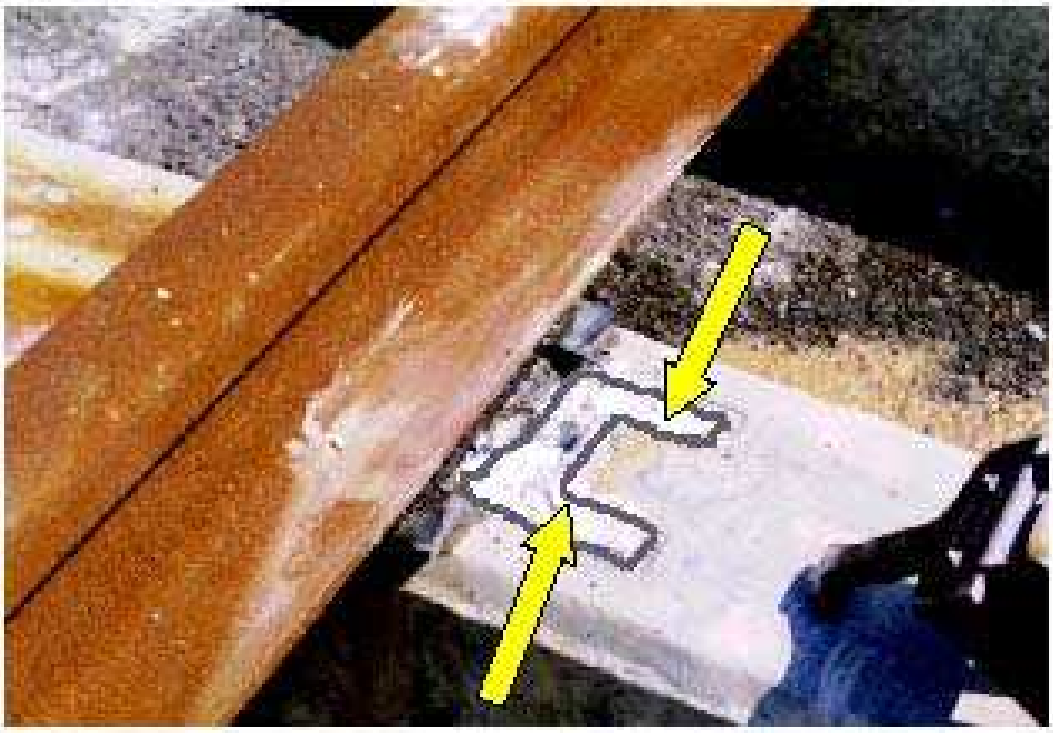

Pour grout into the two footprint channels. The hole is now ready for a replacement shoulder.

14

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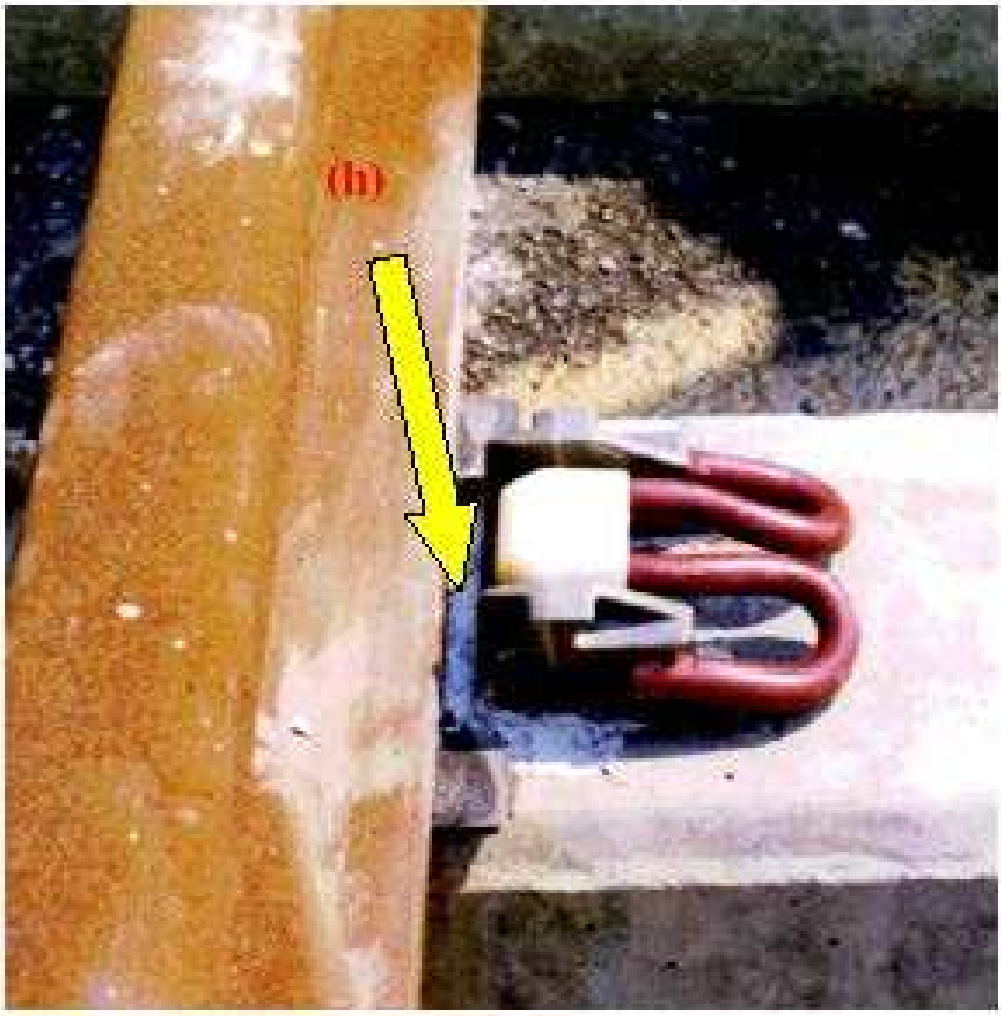


The shoulder is inserted stem first into the hole and gently tapped down to locate in the footprint. Excess grout can be cleaned away with a small spatula. Ensure the area between the rail foot and the front post face of the shoulder (h) is cleaned off down to the concrete level. This allows the post insulator to be fitted correctly once the grout has cured.

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The repair is now complete. Allow for curing time of the grout to full strength, min. 24Hrs in warm conditions up to 5 days in colder ambient temperatures. Where the temperature may fall below 10 degr C, check that the grout is fully cured. Once this period has elapsed the post insulator can be fitted and the clip driven forward to the installed position.

It is important that the post insulator is only fitted after the grout has fully cured, avoiding any rail movement due to traffic disturbing the shoulder position. However, tie security must always be ensured prior allowing any traffic to run, ie enough secured sleepers with side post insulators in place must remain to allow curing time of repaired ties.

Replace any previously removed ballast back into the crib.

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The complete drill is supplied in a metal box that consists of:

-Hilti drill unit

- Core drill Bits

- Drill mounting Frame

- Water supply container with hose attachment

- Water container holding Rig

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## Safety Instructions

The material used in this shoulder replacement procedure should be handled and used in accordance with local Health and Safety Regulations.
Particular attention should be paid to the following:-
-Do not allow resin to get on the skin.
-Use Barrier cream on the skin.
-Always wear gloves when handling materials.
-Always wear eye protection and protective clothing.

**Emergency Procedure:**
-In case of epoxy contact with the skin, wash the skin with soapy water.
Do not use any solvent on the skin!
-In the case of epoxy contact with the eye, irrigate the eye with running water for 15 minutes and obtain medical attention.
-Keep clear of the rotating drill during the core drilling operation.

**Important**

Whilst the information contained in these procedures is correct, failure to carry out each function correctly to a high standard or the use of non specified materials and equipment may result in failure of the FASTCLIP system.

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## Pandrol Fastclip Shoulder Replacement

### Supporting Documents

1. Method Statement
2. Instructions for implanting 8 shoulders
3. MSDS for Araldite LC191
4. MSDS for Hardener LC249
5. Label 38177 (Resin)
6. Label 38178 (Hardener)

**NOT INCLUDED**
Refer to current MSDS

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Quality Endorsed Company

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P.O. Box 4086, Blacktown,
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Australia

Telephone: 61 2 9852 2500
Facsimile: 61 2 9671 7875

## INSTRUCTIONS FOR IMPLANTING APPROX 8 SHOULDERS

1. Chisel 2 grooves along the wall of the drilled holes. Suggest 20mm wide chisel in an impact hammer.

2. Blow out all loose material and water using a dry, oil free, compressed air blast, - ensure full eye protection is worn.

3. Check the fit of the replacement shoulder by inserting into the prepared hole. Ensure that the underside of the head locates on the concrete in the position that the removed shoulder located on.

   Check seven further shoulders in their drilled holes.

4. Place 900cc of resin (yellow liquid) into a 5 litre plastic mixing bucket, add 300cc of hardener (blue liquid) and mix thoroughly until the mix is a uniform green colour.
   Ensure the material at the edges and the bottom of the bucket are thoroughly mixed in.

5. Add one bag of filler to the epoxy mix and mix thoroughly until a uniform light green mix. Ensure the material at the edges and the bottom of the bucket are thoroughly mixed in.

6. Remove the trial fitted shoulder and pour the filled epoxy mix into the hole until the hole is full. Tamp the mix while filling the hole to ensure that no large air pockets are formed.

7. With a spatula or flat strip, push some mix from the hole into the shoulder footprint and around the edges of the hole where the shoulder head will locate.

8. Slowly push the shoulder into the filled hole.

   Tap the shoulder down very lightly with a soft hammer until it seats on the concrete under the head.

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9. An amount of epoxy mix will be displaced during insertion.

   Clean this epoxy away from the gap between the rail and the shoulder to allow the sidepost insulator to fit.

   Do not put the excess epoxy cleaned away from the shoulders back in the bucket.

10. Check that an insulator will fit between the rail and the shoulder.

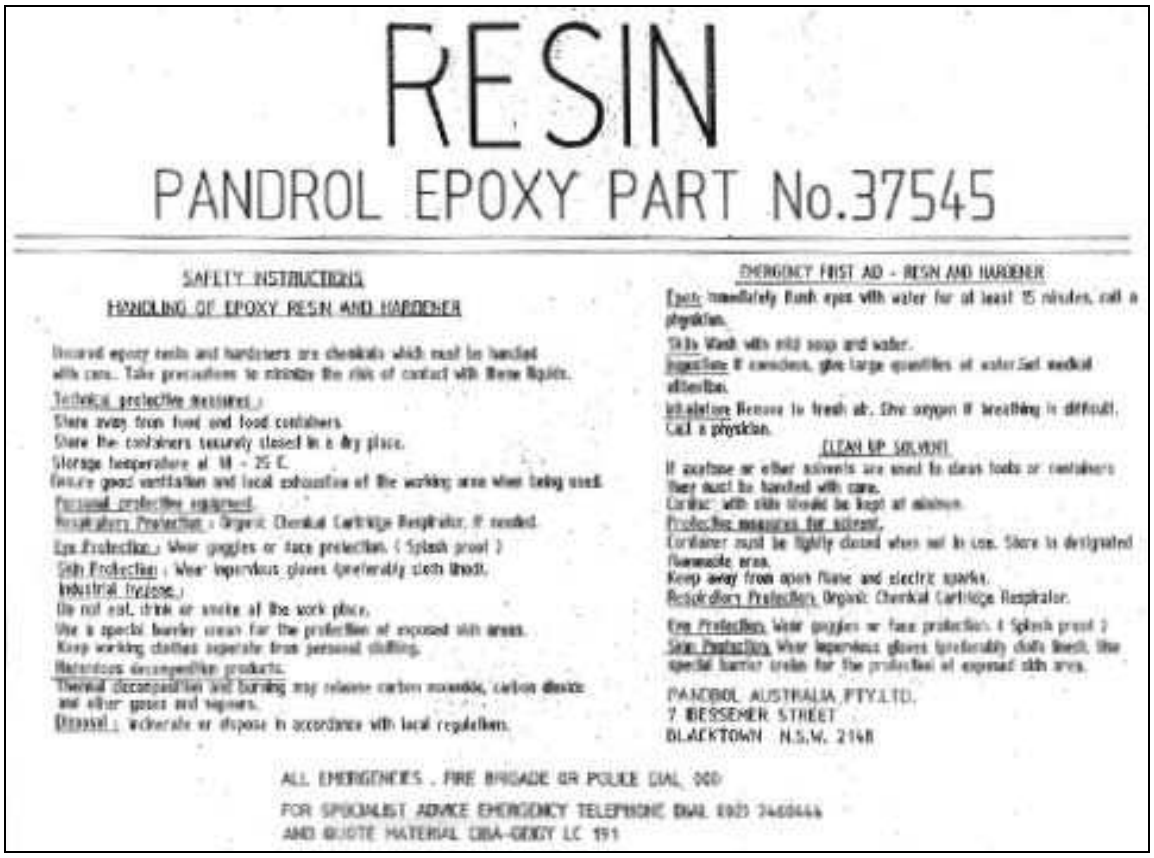
11. Fit the other seven shoulders as above.

12. Leave the shoulders to cure for 24hrs (to 7 days if cold) then clip up.

13. In the cold areas such as tunnels where the temperature may fall below 10C, check that the mix is fully cured, before clipping up.

14. In areas where the sleepers or holes may be contaminated (eg near rail lubricators) ensure that the surfaces are thoroughly clean and free of grease, oil or other contaminants.

    The epoxy mix will only bond to clean dry concrete.



# RESIN

## PANDROL EPOXY PART No.37545

SAFETY INSTRUCTIONS

HANDLING OF EPOXY RESIN AND HARDENER

Uncured epoxy resins and hardeners are chemicals which must be handled with care. Take precautions to minimize the risk of contact with these liquids.

Technical protective measures :
Store away from food and food containers.
Store the containers securely closed in a dry place.
Storage temperature at 10 - 25 C.
Ensure good ventilation and local extraction of the working area when being used.
Personal protective equipment.
Respiratory Protection : Organic Chemical Cartridge Respirator, if needed.
Eye Protection : Wear goggles or face protection. ( Splash proof )
Skin Protection : Wear impervious gloves (preferably cloth lined).
Industrial hygiene :
Do not eat, drink or smoke at the work place.
Use a special barrier cream for the protection of exposed skin areas.
Keep working clothes seperate from personal clothing.
Hazardous decomposition products.
Thermal decomposition and burning may release carbon monoxide, carbon dioxide and other gases and vapours.
Disposal : Incinerate or dispose in accordance with local regulations.

EMERGENCY FIRST AID - RESIN AND HARDENER

Eyes Immediately flush eyes with water for at least 15 minutes, call a physician.
Skin Wash with mild soap and water.
Ingestion If conscious, give large quantities of water.Get medical attention.
Inhalation Remove to fresh air. Give oxygen if breathing is difficult. Call a physician.

CLEAN UP SOLVENT

If acetone or other solvents are used to clean tools or containers they must be handled with care.
Contact with skin should be kept at minimum.
Protective measures for solvent.
Container must be tightly closed when not in use. Store in designated flammable area.
Keep away from open flame and electric sparks.
Respiratory Protection Organic Chemical Cartridge Respirator.

Eye Protection Wear goggles or face protection. ( Splash proof )
Skin Protection Wear impervious gloves (preferably cloth lined). Use special barrier cream for the protection of exposed skin area.

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ALL EMERGENCIES . FIRE BRIGADE OR POLICE DIAL 000

FOR SPECIALIST ADVICE EMERGENCY TELEPHONE DIAL 0101 2468444
AND QUOTE MATERIAL CIBA-GEIGY LC 191

# HARDENER

## UN No.2735 : ACCELERATED CYCLOALIPHATIC AMINE HARDENER

## PANDROL EPOXY PART No.37563

SAFETY INSTRUCTIONS

HANDLING OF EPOXY RESIN AND HARDENER

Uncured epoxy resins and hardeners are chemicals which must be handled with care. Take precautions to minimize the risk of contact with these liquids.

Technical protective measures :
Store away from food and food containers.
Store the containers securely closed in a dry place.
Storage temperature at 10 - 25 C.
Ensure good ventilation and local extraction of the working area when being used.
Personal protective equipment.
Respiratory Protection : Organic Chemical Cartridge Respirator, if needed.
Eye Protection : Wear goggles or face protection. ( Splash proof )
Skin Protection : Wear impervious gloves (preferably cloth lined).
Industrial hygiene :
Do not eat, drink or smoke at the work place.
Use a special barrier cream for the protection of exposed skin areas.
Keep working clothes seperate from personal clothing.
Hazardous decomposition products.
Thermal decomposition and burning may release carbon monoxide, carbon dioxide and other gases and vapours.
Disposal : Incinerate or dispose in accordance with local regulations.

EMERGENCY FIRST AID - RESIN AND HARDENER

Eyes Immediately flush eyes with water for at least 15 minutes, call a physician.
Skin Wash with mild soap and water.
Ingestion If conscious, give large quantities of water.Get medical attention.
Inhalation Remove to fresh air. Give oxygen if breathing is difficult. Call a physician.

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If acetone or other solvents are used to clean tools or containers they must be handled with care.
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Protective measures for solvent.
Container must be tightly closed when not in use. Store in designated flammable area.
Keep away from open flame and electric sparks.
Respiratory Protection Organic Chemical Cartridge Respirator.

Eye Protection Wear goggles or face protection. ( Splash proof )
Skin Protection Wear impervious gloves (preferably cloth lined). Use special barrier cream for the protection of exposed skin area.

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# Chapter 15 Installing Fastclip Weld-on shoulders

The following method of installing Fastclip Weld-on shoulders is approved for use in RailCorp.

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## Installing FASTCLIP Weld on Shoulders

**Instruction to repair broken FASTCLIP FC1507 shoulder, P/N. 9183 or 10824 with 'weld on' retrofit field repair part 11484.**

CONDITIONS OF USE

1. NEVER USE THIS REPAIR METHOD OF BROKEN SHOULDERS IF THERE ARE VISIBLE STRUCTURAL CRACKS IN THE SLEEPER.
2. NEVER WELD MORE THAN ONE SHOULDER ON ANY TWO SUCCESSIVE SLEEPERS IN TRACK.

**Equipment Required**
Pandrol Hand Tools, Extraction Tool - LP15822, Installation Tool - LP15147 or equivalent.
Angle Grinder, Gas or Oxy acetylene torch for heating, welding equipment and electrodes as specified.

**Welding Specifications**
Welding electrodes shall be 3.2mm, SUPERCAST Ni/Fe, suitable for higher strength welding of Spheroidal Graphite Cast Iron in accordance with WIA Product Data Sheet WCD 6129 or equivalent.

**Safety Instructions**
Personal Safety Equipment. Shoes, hearing and eye protection. Gloves to handle hot material, and all necessary specific site safety apparel.

**Work instruction - Procedure**
Position the FASTCLIP extraction tool and completely remove the FASTCLIP and toe insulator from the broken shoulder, and then remove the sidepost insulator.
Visually inspect the sidepost insulator, toe insulator and Pandrol FASTCLIP for damage. Retain all undamaged components for re-assembly. Visual inspection can usually determine if new components are required. NB. If the shoulder is damaged during a derailment, most parts will need to be replaced.

**Weld Preparation**
Grind as indicated.

Use an angle grinder to prepare the weld surfaces as indicated.

Grind to these datum surfaces, both sides.
Remove rust/scale from floor for a clean welding surface.
Use the top edge as a datum and grind vertically as illustrated.

DWG 12426 Iss.1

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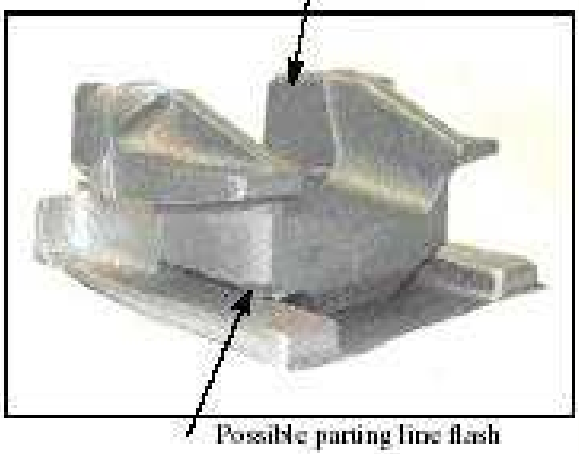
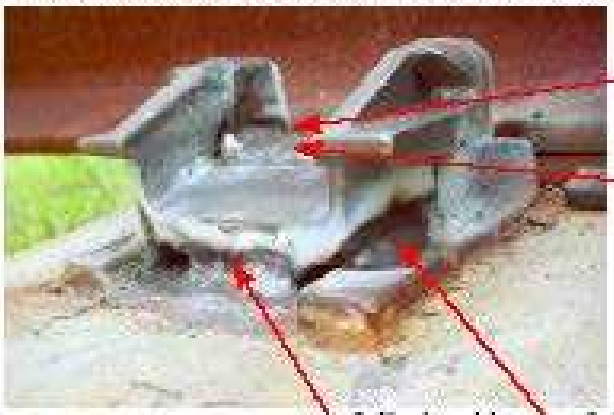
Page 2 of 3

**Pre-Alignment and Positioning**
Ensure the new shoulder can be correctly positioned into the existing broken shoulder. NB. For correct alignment, grinding off the parting line flash from the new shoulder may be required.




**Preheat both shoulders and Align**
With the aid of a gas or oxy acetylene torch, with a "Neutral" flame, heat both shoulders to approx. 200-250° Celsius. Using heatproof gloves, position the new cast shoulder into alignment as shown. Ensure the new shoulder is laterally centralised and firmly pushed forward in readiness for welding.

**Welding**
Do not attach welding "Earth lead" to rail. Ensure earth, electrode settings and connections are correct.
While holding in aligned position, weld in locations as indicated:
1. First, "tack weld" across the top and centre. Ensure not to destroy the centre park position locking feature. Inspect the alignment is undisturbed before further welding.
2. Fully weld the back of the shoulder between the floor and the chamfer.




**Summary**
Do not weld on inside of shoulder where sidepost insulator is re-assembled.

**Welding sequence**
1. First tack weld top centre.
2. Second weld should be at the back.
3. Fully weld the sides indicated by chamfered weld preparation.
4. Fully weld the top with approximately 4-5 mm fillet welds.

**Post weld treatment**
Do not accelerate the cooling down process.

**Final Inspection and Assembly**
Allow components to cool fully, before proceeding. Inspect and ensure there is no excess weld upon completion. If necessary, grind off any excess weld that may obstruct the re-assembling of components. Inspect and ensure there is no cracking in either shoulder or the welds.

Assemble sidepost insulator and check for alignment and functionality. Any damaged components must be replaced.

Assemble FASTCLIP with toe insulator into final position.

Final visual inspection and check for fit & functionality.

DWG. 12420 Iss 1

PANDROL FASTCLIP

Page 1 of 3

# PRODUCT DATA SHEET WCD 8129

## SUPERCAST Ni/Fe

- Nickel-Iron Core Wire/Basic, Graphite Coating
- Machineable Nickel Iron Deposit for the Higher Strength Welding o Cast Irons, Particularly SG Irons
- Stable Performance on Weldarc 12P and 140 Welding Machines

### IDENTIFICATION

| COATING | TIP |
|---|---|
| BLACK | GREEN |

### CLASSIFICATION

| AWS A5.15 |
|---|
| ENiFe-Cl |

### DESCRIPTION AND APPLICATIONS

SUPERCAST Ni/Fe is a basic, graphite coated AC/DC electrode for the higher strength welding of cast irons. It is characterised by a soft, smooth arc with low penetration and spatter levels on both AC and DC power sources. Ease of striking is a feature of Supercast Ni/Fe.

This electrode is made from a Nickel-Iron core wire and produces a ductile, machineable weld deposit with the extra strength required for welding SG (Spheroidal Graphite) irons. Supercast Ni/Fe may also be used for the repair and reclamation of all standard grades of grey cast iron, malleable iron, austenitic cast iron and some grades of mechanite cast iron. It is ideally suited to the dissimilar welding of these irons to steels.

### TYPICAL ALL WELD METAL COMPOSITION (Wt%)

| Mn | Ni | S | Fe |
|---|---|---|---|
| 0.85 | 57.8 | 0.007 | Bal |

### DEPOSIT PROPERTIES

| YIELD STRESS | TENSILE STRENGTH | DEPOSIT HARDNESS |
|---|---|---|
| 300 MPa | 500 MPa | 200 - 220 HV(30) |

### OPERATIONAL AND PACKAGING DATA

| ELECTRODE SIZE (mm) | ELECTRODE LENGTH (mm) | WELDING CURRENT RANGE* (amps) | PACKAGING (kg) | | | APPROX NO OF RODS PER KG | PRODUCT NUMBER |
|---|---|---|---|---|---|---|---|
| | | | PKT | CTN | MINIPAK | | |
| 3.2 | 350 | 80 - 100 | 2.5 | 15 | 0.5 | 30 | SNIFE32<br>SNIFE32M |
| 4.0 | 350 | 80 - 130 | 2.5 | 15 | – | 25 | SNIFE40 |

* Recommended for DC-, or AC (minimum 45 OCV) operation

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The information contained or otherwise referenced herein, is presented only as "typical" without guarantee or warranty, and Welding Industries of Australia expressly disclaims any liability incurred from any reliance thereon. Typical data is obtained when welded and tested in accordance with AWS and or ASNZS specification. Other tests and procedures may produce different results. No data is to be construed as a recommendation for any welding condition or technique by Welding Industries of Australia.

PANDROL FASTCLIP

DWG. 12426 Iss.1

# Chapter 16 Delkor Elastomeric Rail Fasteners

## C16-1 Inspection and Maintenance

### Delkor Elastomeric Rail Fasteners
### Alt 1 and Egg
### Maintenance and Inspection

1.0. **General**

The Delkor Egg and Alt 1 fasteners are basically maintenance free. Provided the units are installed correctly, there are no maintenance requirements for at least 30 years.

2.0. **Inspection**

The track needs to be inspected for the following conditions:-

- All clips are fitted and in their correct position and condition (including rail pads and insulators where fitted).
- There exists no undue water around the fasteners due to blocked drains, seepage, leakage etc.
- There exist no metal objects or rubbish jammed between the rail and slab.
- There is no excessive build up of grease or fuel spillage on the fasteners.

3.0. **Regular Checks**

The following checks need to be made on the fixation and rail/clip components.

a) 3 months after track operation commences the torque of the screwspikes/bolts, etc should be checked on a random basis. Approximately 20 to 50 fixations should be checked.

| Track Form | Recommended Nominal Screwspike Torque |
|---|---|
| Concrete Slab with cast in HDPE dowel using Ss8 screwspike & Fe6 washer | 250 – 270Nm |
| Timber sleeper Based on 19mm pre drilled hole in Tallow wood using Ss8 screwspike & Fe6 washer | 250 - 270Nm |
| Polymer Sleeper with cast in Nylon Dowel Ss8 screwspike & Fe6 washer | 160 – 180Nm |

b) 1 year after track operation commences the check a) to be repeated and then repeated on a 5 to 7 year schedule depending on traffic.

c) Condition of rail pads and insulators to be regularly checked on a 5 to 7 year basis. This may need to be reduced depending on track condition and operational frequency.

d) In corrosive areas the conditions of all components of the fastener and its fixation to be checked. In wet area the fixation should be checked annually by removal of one or more units to monitor corrosion.

## C16-2 Installation of Delkor fastenings

### C16-2.1 Acceptance requirements

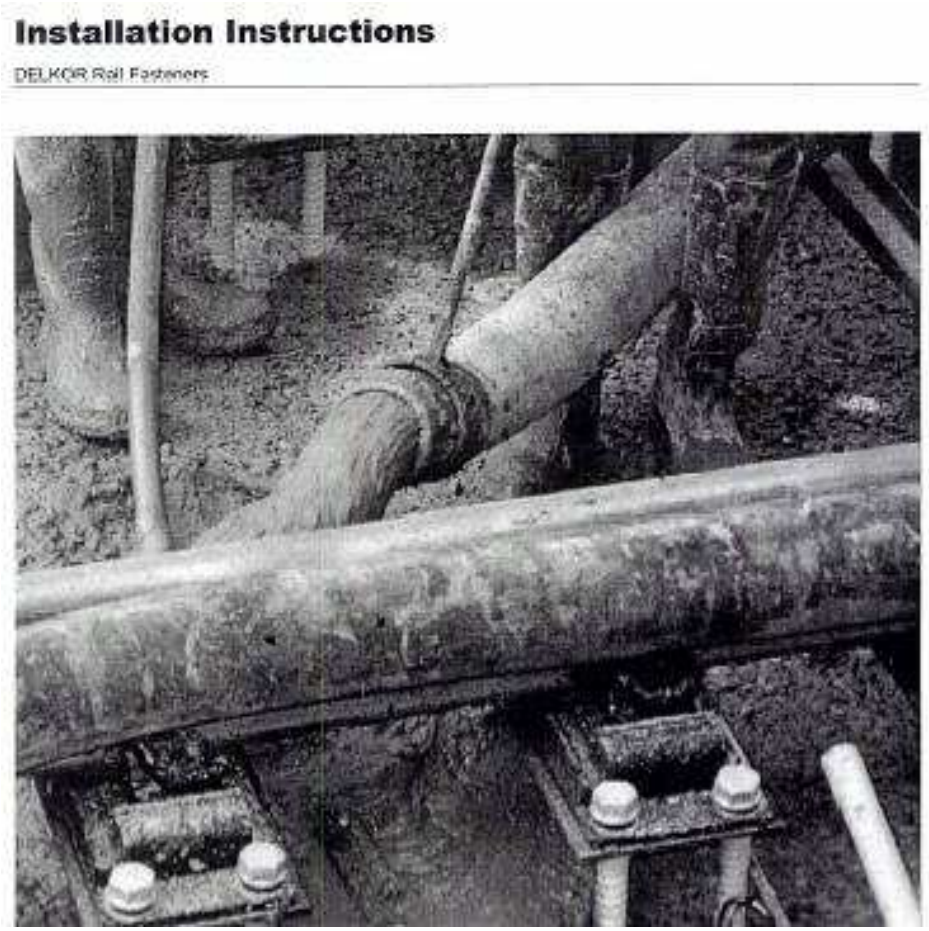
*The following requirements have been extracted from RailCorp standard ESC 220.*

Track slabs shall be designed and constructed in accordance with the requirements of RailCorp Engineering standard ESC 362 – "Track Slabs". In addition at the slab fastening system interface the following acceptance limits apply:

| Item | Limit | | Tolerance |
|---|---|---|---|
| Finished surface of the slab | Design level | | + 0mm<br>- 5mm |
| | No voids | | NA |
| Inward cant of rail | Plain track | 1:20 | ± 1 in 400 |
| | Turnouts | 0 | |
| *Note need for cant transition over 2400mm* | Turnout transition to plain track | 0 to 1:20 | |
| Differential tilt of the rail seat in the direction of the rail | 0 | | 1 in 100 |
| Concavity or convexity of the rail seat in any direction | 0 | | ± 0.5mm |

*Table 22 – Slab track acceptance limits*

### C16-2.2 Installation



## Installation Method

DELKOR Rail Fasteners can be mounted in several different ways. Various methods for the installation of rail fasteners on concrete, steel and timber are described.

The mounting of rail fasteners on concrete can be subdivided into two main methods named after the working direction of the resp. method. With the so-called TOP-DOWN METHOD, the aligned track is supported in a temporary support complete with fasteners and the concrete or grout poured up to the underside of the fasteners. With this method, the working direction is from the top (aligned track) to the bottom (grouting or concrete pouring). It is therefore called the TOP-DOWN METHOD. This way of mounting rail fasteners is best suited for newly constructed railway lines. A lateral and vertical adjustment of the rail fasteners is not required. The one-piece DELKOR rail fasteners, where the top plate is firmly bonded with the base frame by vulcanization, are especially suited for this mounting method. Another way of mounting is the so-called BOTTOM-UP-METHOD with which the working direction is from the bottom to the top. The rail fasteners are mounted on an already completed concrete or steel base structure.

## Spacing of Rail Fasteners

Regardless of the installation method, the spacing of the DELKOR rail fasteners is variable between 450 and 900mm. It has a decisive bearing on the dynamic stiffness of the rail and it is to be adjusted to the specification of the superstructure and the rolling stock. The proper spacing can be determined by DELKOR, using special calculation programs, or be specified by the client.

## 1. TOP-DOWN METHOD

With the TOP-DOWN METHOD, the fasteners are fixed to the rail and the concrete or grout poured up to the underside of the fastener. The track complete with the attached fasteners is mounted on a temporary support (fig. 1). The track is accurately aligned in both lateral and vertical positions as well as superelevation using a jack (fig.2 ). The fasteners complete with base plate, dowels and screwspikes/anchors or threaded rods are mounted to the rail by the resilient clip inclusive of rail pads and insulators as required (fig. 3). The formwork and steel reinforcement is positioned (fig.4), the track alignment checked and the concrete poured. The temporary support is removed only after the concrete or grout has fully set.

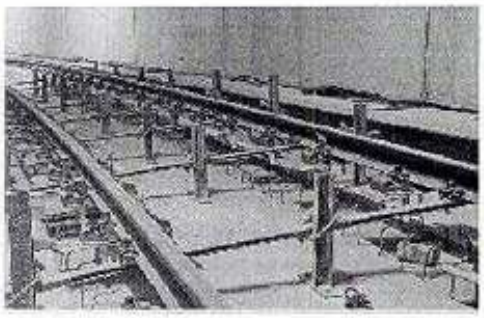


*Fig 1: Alt I®, mounted on temporarily supported rails and prepared for the concreting into longitudinal plinths.*

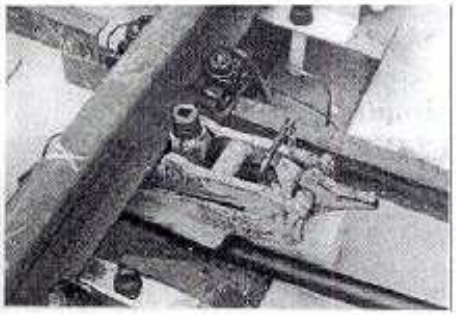


*Fig.2: Lifting device for the raising of the rail on temporary support.*

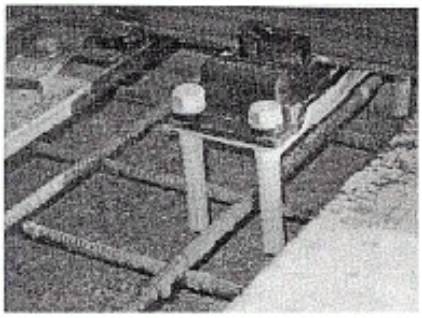


*Fig. 3: Detail view: Rail fastener Alt. I,* SL.092 type, fixed to the support rail, assembled with base plate and anchoring elements.*

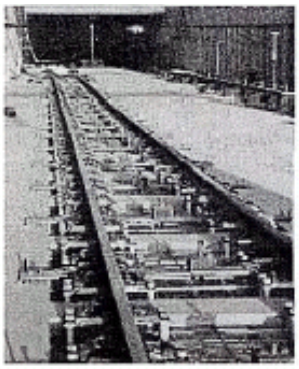


*Fig. 4: Rails on support with pre-mounted rail fasteners, reinforcement installed into the formwork (below).*

**There are various TOP-DOWN METHODS**

1.1. Installation on poured socles (drawing 1)
1.2. Installation on concrete longitudinal plinths (drawing 2)
1.3. Installation on concrete track slab (drawing 3)

**Advantage:**
The TOP-DOWN-METHOD avoids the accumulation of tolerances of slabs/plinths, rail fasteners and rails, thus minimizing possible track inaccuracies.

**Tip:**
Ensure the steel reinforcement does not foul with the fastener fixation bolts studs – fibre concrete may be an option to consider.

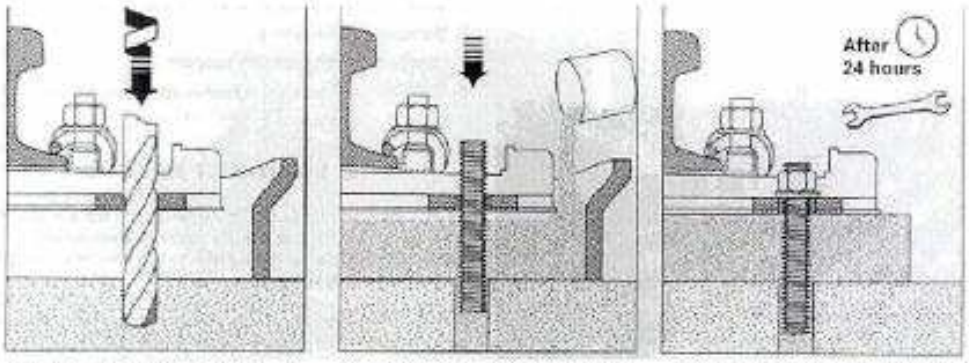
## 1.1. TOP-DOWN METHOD

**Installation on Socles**

***Operating Sequence:***

1. Installation of temporary support and gauge tie bars, aligning of rails
2. Mounting of fasteners
3. Drilling of holes into the foundation (track base slab)
4. Mounting of the formwork for the socles
5. Pouring of grout up to a level of abt. 5mm below fastener/base plate
6. Placing of threaded rods/anchors or anchor bolts with plastic dowels
7. Complete pouring of grout in formwork up to underside of fastener
8. Removing of formwork
9. Removing of temporary support
10. Tightening of the bolts (observing grout setting time)

**Dwg 1. Installation on poured socles showing DELKOR rail fastener Alt. I®**




*Drilling of holes with supported rail, setting-up of formwork.*

*Grouting, inserting of threaded rods/anchor bolts with/without dowels*

*Tightening of nuts and removal of formwork after grout setting time.*

## 1.2. TOP-DOWN METHOD

**Installation on Concrete Longitudinal Plinths**

The use of longitudinal plinths has proven superior to socles or transverse concrete beams (or sleepers) due to their inherent guidance in case of derailment (fig.5). The track is supported on a stable temporary support, the pre-assembled bled rail fasteners fixed to the rail and then the track aligned accuracy prior to pouring the concrete to form the longitudinal plinths (fig.6).

*Fig. 5: Delkor Egg® mounted on concrete longitudinal plinths.*

*Fig. 6: Supported rail, formwork for the longitudinal plinths.*

**Specific Advantage:**

The drilling of dowel/anchor holes and the adjusting for both lateral and vertical alignment to overcome the unevenness is dispensed with.

***Operating Sequence***

1. Set up rails on an adjustable temporary support with gauge tie bars
2. Mounting of fasteners
3. Placing of threaded rods/anchor bolts with plastic dowels
4. Set up formwork for longitudinal plinths
5. Pouring of in-situ concrete
6. Removing of formwork
7. Dismantling of temporary support
8. Tightening of the fastener fixing screws (observe concrete setting time).

*Fig. 7: Mounting of Delkor Egg® type rail fasteners on steel bridge, screw fitting on welded plates.*

*Fig.8: Screw-fitting of rail fasteners on timber sleepers.*

*Fig. 9: Alt. I ® rail fasteners, mounted on timber sleepers.*

## 1.3. TOP-DOWN METHOD

**Installation on Concrete Track Slab**

With this method, the rail fasteners are pre-assembled to the rails and their anchoring elements cast into the slab. The track is hereby accurately aligned and fixed on a temporary support.

**Specific Advantage:**
The drilling of dowel/anchor holes and the adjusting for both lateral and vertical alignment to overcome any unevenness is dispensed with. The dimensional tolerance for this mounting method with respect to lateral and vertical position, superelevation and rail gauge is up to ± 1 mm.

***Operating Sequence***

1. Set up rails on an adjustable temporary support with gauge tie bars
2. Mounting of fasteners
3. Placing of threaded rods/anchor bolts with plastic dowels
4. Mounting of formwork for the slab edges
5. Pouring of in-situ concrete of the track slab up to the lower side of the fastener/base plate
6. Removing of formwork
7. Dismantling of temporary support
8. Tightening of the bolts (observe concrete setting time).

*Fig. 7: Mounting of Delkor Egg® type rail fasteners on steel bridge, screw fitting on welded plates.*

*Fig.8: Screw-fitting of rail fasteners on timber sleepers.*

*Fig. 9: Alt. I ® rail fasteners, mounted on timber sleepers.*

## 1.3. TOP-DOWN METHOD

**Installation on Concrete Track Slab**

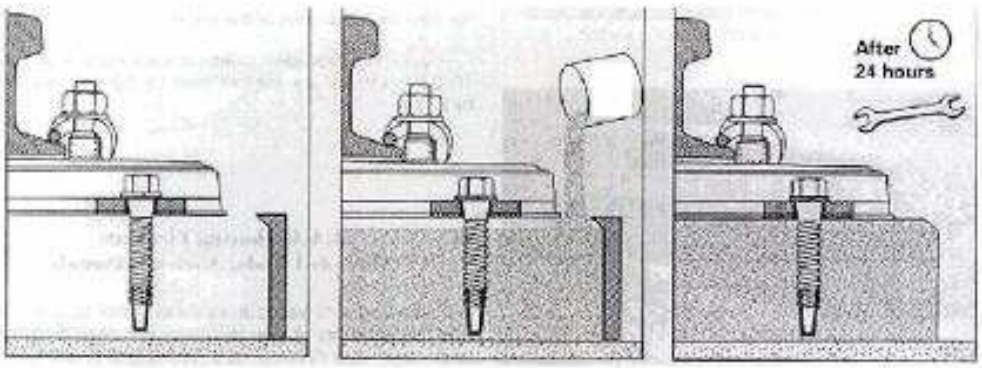
With this method, the rail fasteners are pre-assembled to the rails and their anchoring elements cast into the slab. The track is hereby accurately aligned and fixed on a temporary support.

**Specific Advantage:**
The drilling of dowel/anchor holes and the adjusting for both lateral and vertical alignment to overcome any unevenness is dispensed with. The dimensional tolerance for this mounting method with respect to lateral and vertical position, superelevation and rail gauge is up to ± 1 mm.

***Operating Sequence***

1. Set up rails on an adjustable temporary support with gauge tie bars
2. Mounting of fasteners
3. Placing of threaded rods/anchor bolts with plastic dowels
4. Mounting of formwork for the slab edges
5. Pouring of in-situ concrete of the track slab up to the lower side of the fastener/base plate
6. Removing of formwork
7. Dismantling of temporary support
8. Tightening of the bolts (observe concrete setting time).

**Dwg 2. Installation on concrete longitudinal plinths showing Egg® DELKOR rail fastener**




*Pre-assembling of rail fastener to rail, positioning of formwork, inserting of screwspikes rods, dowels (optional).*

*Pouring of in-situ concrete.*

*Tightening of screws after setting-time, dismantling of formwork.*

### 2.3. BOTTOM-UP METHOD

**Installation of Timber Sleepers**

Some DELKOR rail fasteners, due to their specific geometry, are suited for the mounting on timber sleepers (fig.8 and 9). With these the mounting bolts are provided at he ends of the fastener. These fasteners can also be provided with elongated holes and serrated locking/washing system for lateral adjustability.

The mounting on timber sleepers basically works exactly like that on a prefabricated concrete track slab. Commercially available screwspikes are suitable for the mounting of Egg® and Alt. I® rail fasteners.

## 3. INSTALLATION ON CONCRETE FOUNDATION

### 3.1. Temperatures and Weather Conditions

The temperature and weather conditions must be in line with the product being used whether it is epoxy, concrete, mortar or grout. Manufacturer's recommendations should always be followed and products selected in accordance with prevailing conditions.

For both conditions of direct sunlight and rain, covers must be available to protect the new work if required.

### 3.2. Preparation of the Foundation

The preparatory treatment of the concrete foundations is of great importance. Even old concrete foundations can be pretreated. The foundation needs to be thoroughly cleaned. Hidden grouted areas have to be dust-free, clean, and free from cement scale and oil. Drilled holes are to be blown clean with compressed air. To avoid the formation of dust, cement scale should be removed with a needle tool (minimize dust).

In pouring the concrete for longitudinal plinths and grouting the socles, care has to be taken to wet the mounting locations at least 6h in advance, depending on the capillary absorbency, in order to allow the water to penetrate into the adjacent concrete for better adhesion. The watering also keeps the adjacent concrete from dehydrating the grout or the concrete.

When a concrete foundation in the form of a track slab is new and the rail fasteners are subsequently grouted on it, the surface has to be broom-roughened, before hardening, in order to achieve a high degree of bonding.

When retro-fitting rail fasteners on aged concrete foundations, additional preparatory measures have to be taken, depending on the quality of the existing concrete. Contaminants have to be totally removed. Brittle concrete layers are to be removed by needle tools or similar (Sand blasting). If their thickness exceeds 10mm, they have to be removed with descaling machinery or equipment.

*Fig 10: Delkor Egg® employed in a switch Blade/sliding bolster area.*

*Fig. 11.: Delkor Egg® in the entry area of a switch, with safety rails.*

*Fig. 12: Delkor Egg® in the entry area of a Switch, without safety rails.*

*Fig. 13: Details view: Temporary support for the positioning of the rails.*

## 3.3. Formwork

Principally, formwork material must not be porous. When grouting socles, care has to be taken to treat the formwork with release agent for improved removal. Before that, leakages between base unevenesses and the edges of the formwork should be sealed with a suitable sealant.

The formwork (socles) should extend about 20-25mm on all sides. It should also extend at least 25mm above the top of the socles. Chamfers or bevels on the top edges can be achieved by fixing 45 degree beading on the inside of the formwork. Unless the pouring is carried out using pumps or injection equipment, a funnel-shaped head box on the side of the formwork should be used. With this additional head, the flow characteristics of the material will be improved.

Formwork for longitudinal plinths or track slab wider than 1000mm should have the formwork on the feed side raised by 25mm.

## 3.4. Anchoring Elements

**Threaded Rods, Anchors, Dowels**

The fastening with plastic dowels and anchor bolts guarantees the possibility of their replacement in case of corrosion or damage. After the pouring, threaded rods or anchors are perfectly bonded with the foundation. The replacing of these elements required special drawing-out of coring equipment. The metals employed should, therefore, be suitably surface-treated for corrosion.

## 3.5. Anchors

**Size of Drilled Hole and Pull-out Strength**
The gap between the bore of the drilled hole and the threaded rod (annular gap) is crucial for pouring-in the fastener fixing components. Depending on the particle grain size in the grout, the following formula applies to the dimensioning of the annular gap:

**Grout thickness (min.) = grain size (max.) x 3**

**Drilled hole size (min.) = Diameter* (max.) + 2 grout thickness (min.)**

On bonding the fixing components with epoxy resins, the manufacturer's advice relating to the dimensioning of the drilled hole has to be observed. Roughly, the following formula applies to the drilled hole dimensioning of a bonded anchor.

**Drilled hole (min.) = diameter* (max.) + 10mm**

Further detailed manufacturer's instructions with respect to the size of the drilled hole can be found in the directions of use of the drilled hole can be found in directions of use for the reps. grout/cement. For correctly dimensioned annular gaps and carefully prepared holes, the pull-out strength (anchor pull testing) for the fixing components grouted in the foundation is roughly calculated to the following formula:

$$\text{Pull-out strength} = \frac{\text{tensile load}}{\text{circumference x bond length (anchor)}}$$

**Tip:**
The pull-out strength of commercially available grout is between 4 and 12N/mm$^2$.

## 3.6. Grout and Cement

With the TOP-DOWN METHOD, commercially available grouts* of either cement or two-pot epoxy resins are used for the installation of DELKOR rail fasteners. The manufacturer's user directions for the resp. grouts/cements employed are to be strictly observed.

* Diameter of the fixing components (threaded rod, anchor, dowel etc.)
* Grouts on the basis of cement or two-pot epoxy mortars have proved reliable.

## 3.7. Grouting and Time to be allowed before Dismantling the Formwork

Principally, on making socles for rail fasteners with grouting grout, care has to be taken to pour into the formwork only from one side. This causes the air to escape from underneath the rail fastener/base plate.

By pouring concrete for longitudinal plinths track slabs, where the formwork is only on the sides, the use of the slumping up to the underside of the fasteners in one direction minimizes the entrainment of air under the fasteners. Vibration units should not be used directly under the fasteners themselves but only between them. In general, due to the load distribution of the fastener itself, minor imperfections and air bubbles under the fastener can be tolerated. In the event that a high degree of air bubbles occur, they can be filled.

The material quantity is determined by the following formula:

**Volume = Length x width x grouting height x number of underpoured socles**

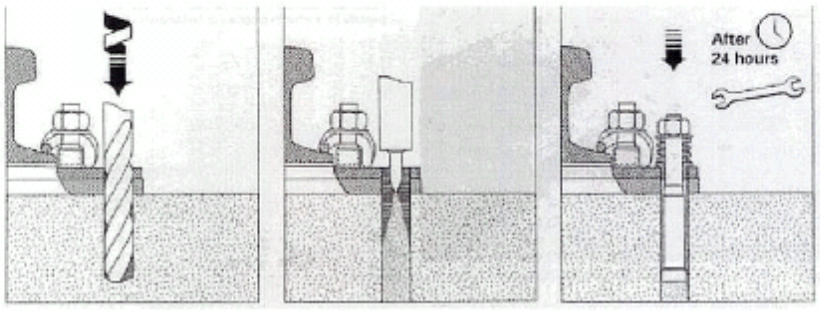
With larger grouting heights, e.g. longitudinal plinths, a constructional reinforcement is to be used. In such cases, fibre concrete can also be used. The constructional reinforcement is to be provided with a cover of at least 20mm. Seen statically, a minimum 15mm layer thickness of the grouting height is to be planned. In the case of additional dynamic stress, the minimum grouting height should amount to 20mm.

**Tip:**
The grouting must not be interrupted, e,g, by lack of material, coffee or lunch breaks or work pauses.

With regard to the time to be allowed before removing the formwork, it is recommended to follow the users directions of the manufacturers of the resp. grouting materials. The formwork of grouted socles on a cement basis is normally dismantled after 24 hours. After that period, the strengthening of the grout has advanced to a point where the fixing components of the rail fasteners may be tightened.

Tip:
The curing process of cement like materials is associated with the generation of heat. Therefore, appropriate measures have to be taken to avoid a premature loss of moisture.

**Dwg 3. Installation on concrete track slab, showing DELKOR Rail-Pad (DRP®)**




*Drilling of holes through the holes of the rail fastener base frame.*

*Pouring of grout on the basis of cement or epoxy resin.*

*Inserting of threaded rods after setting-time, tightening of nuts.*

*Fig. 14: Delkor Egg® for the Fastening of safety rails.*

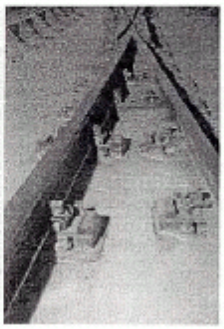


*Fig. 15: Alt. 1® in the entry area of a crossing.*

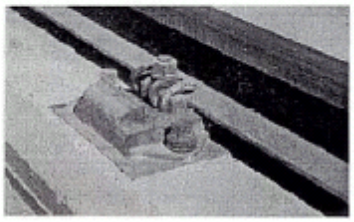


*Fig.16: Alt. 1® installed on concrete longitudinal plinths.*

### 3.8. Tools and Devices

1. Mixer (positive or gravity mixer)
2. Power and water supply
3. Formwork material4) with fixing components and separating agent
4. Compressed air, compressor or industrial vacuum cleaner.

To make poured socles for rail fasteners, a small positive mixer is sufficient for the mixing of the cement mortar. However. For the production of longitudinal plinths or track slabs, we recommend the use of continuous feed pumps.

## 4. To be observed during Installation of DELKOR Rail Fasteners

1. To maintain the operation of the fasteners, the side openings (air slots) have to stay open by all means.
2. The base plate (metal or plastic) has to be installed under the CLOUTH rail fastener to provide for a load distribution on the foundation and prevents the penetrating of concrete or mortar into the hollow space underneath the rail fastener. This hollow space needs to be retained as working area for movement of the top plate of the rail fastener.
3. A stress-free mounting of the rail fasteners is necessary. Unevenness in levels has to be evened out by using base plates of varying thickness, as initial stress (horizontal/vertical) in load or tension may lead to accelerated ageing of the rail fastener's elastomer.
4. If rail fasteners are exposed to aline air or water respectively or other aggressive media, they have to be provided with an adequate corrosion protection.
5. In dry tunnels, DELKOR rail fasteners may be used without special protection against corrosion.
6. The anticorrosive paint of the rail fasteners must not be damaged on mounting of the fasteners.
7. Permanent contact of the rail fasteners with grease, oils or other hydrocarbons is to be avoided.

4) formwork material sufficient for 150m of track has proven an adequate quantity for a smooth progress of building activities.

DELKOR

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# Chapter 17 Trip Gear Magnets - Maintenance Guidelines

## C17-1 Introduction

This chapter provides guidelines for the protection and repair of track magnet installations.

## C17-2 Overview

Retractable train trips are installed on XPT, Xplorer and Endeavour trains. The trips are needed to operate in conjunction with trip arms in the Metropolitan area. The trips are not, however, required in the Country area. To reduce the potential for damage to the trip mechanism and unnecessary emergency brake applications, an induction system, using track magnets, has been installed to raise and lower the trip gear when it leaves or enters the Metro area.

To raise or lower trip gear, two pairs or "sets" of magnets are attached to sleepers in the 4-foot at set distances. See Figure 21 and Figure 27 for configuration details.

One pair, the South Pole magnets, are coloured BLUE, and LOWER the trip gear. The second pair, the North Pole magnets, are coloured YELLOW, and RAISE the trip gear.

South Pole magnets are ALWAYS on the Sydney side of North Pole magnets.

Magnets are set at rail level +0/-10mm and attached with epoxy to concrete sleepers or coach screwed to timber sleepers.

In addition, at each location, signs have been erected trackside to alert the driver when the Automatic trip gear is lowered or raised. Health Warning signs have also been erected to warn of the hazard to people with heart pacemakers.

## C17-3 Locations

Track Magnets & Signage have been installed at the following locations:

**Metro South**

Macarthur - City end of structure 56+859, 56.857km to 56.897km Up and Down Main South.

**Metro West**

Lithgow - 156.800 km to 156.840 on the Up and Down Main West.

**Metro North**

Islington Jct - 164.544 – 164.593 on the Up and Down Main (these are currently in ARTC territory and are not maintained by RailCorp).

**Metro Illawarra**

Moss Vale Line - 90.311 on the Up and Down.

**XPT & Xplorer Centres**

Sydenham, Eveleigh and Broadmeadow Centres have South magnets installed at departure roads ensuring the trip arm is lowered on vehicles as they leave the maintenance centre.

## C17-4 Maintenance

## C17-4.1 General

Track staff are responsible for the repair of the magnet installations.

## C17-4.2 Storage and Handling

The track magnets contain STRONG magnetic fields. Bringing electronic watches or equipment (Laptops, etc), credit cards / passes etc with magnetic strips to within 300mm of the magnets will result in the data being destroyed irrespective of the exposure time. Exposures in the 300mm to

600mm range from the magnets will not result in the data being immediately destroyed, but should also be avoided. Staff should remove wallets, watches etc before working with the magnets.

**WARNING**

**Staff with pacemakers MUST NOT place pacemakers any closer than 500mm metres to this equipment.**

**Staff with hearing aids MUST not place hearing aids within 125mm of the magnet.**

Blue and yellow magnets MUST NOT be stored or transported together. Separate them by at least 10m.

## C17-4.3 Action required if magnets are damaged or missing

1. If any magnets or signs are missing or damaged, they should be identified on the diagram provided (Figure 27) and reported to the Team Manager for replacement in accordance with Section C17-4.7 below.
2. Repairs or replacements are required within 24 hours.
3. In an emergency, if replacement magnets are not available, there is a short term alternative available for double track installations only. Temporarily remove the middle pair of magnets from the adjacent track. (Make sure you take the correct magnet (yellow or blue) and install them to replace the damaged magnets. Figure 27 shows the normal configuration. Figure 28 shows the magnets that can be moved to replace damaged or missing magnets.
4. If replacement magnets cannot be installed within 24 hours the maintenance supervisor is required to notify the signaller by reporting the location and track. The signaller will inform the train driver, who is able to take action to manually raise or lower the trip gear. This is not a desired option and is only be used in an emergency situation of magnet shortage.
5. When replacement magnets have been installed notify the signaller so that normal operation may be resumed.

## C17-4.4 Removal of Magnets for track maintenance activities

1. Magnets will be damaged if left on track during track renewal, resurfacing, ballasting, rerailing, resleepering and other major track work.
2. Remove the magnet ONLY for any work that does not require removal of sleepers.
3. If sleepers are disturbed then the magnet AND baseplate should also be removed. The position of the magnets will need to be marked and recorded BEFORE they are removed so that they can be re-installed in the same place and in the same order (DON'T mix the BLUE and YELLOW magnets). The position can normally be marked on the web of the rail at each magnet. If, however, the rail is also being removed, a recoverable mark should be established outside the area that will be disturbed by work.
4. The magnets should be re-installed as soon as possible after the work and BEFORE the running of any XPT, Xplorer or Endeavour trains.
5. Re-installation should follow the installation guidelines in Section C17-4.7.

## C17-4.5 Disposal

When magnets are no longer required they should be returned (intact or damaged) to Fischer Industries.

## C17-4.6 Signage Installation/Replacement

### C17-4.6.1 Automatic Trip Gear sign

The Automatic Trip Gear Raised/Lowered sign is a 800mm x 600mm colourbond sign with metal frame and three (3) metre post attached to back of the sign. The background is to be reflective blue with 90mm size reflective white lettering. (see Figure 25 and Figure 26).

### C17-4.6.2 Health Warning sign

The Health Warning sign is a 550mm x 650mm colourbond sign with metal frame allowing signs on back and front on a 2.5 metre post. The background is to be reflective white with red (70 mm) and black lettering (30mm and 20 mm) and magnet diagram (120 mm).

These signs are to be erected adjacent to magnets on both sides of track at a 450 angle to the track and on nearest track access point if within 100m of magnets.

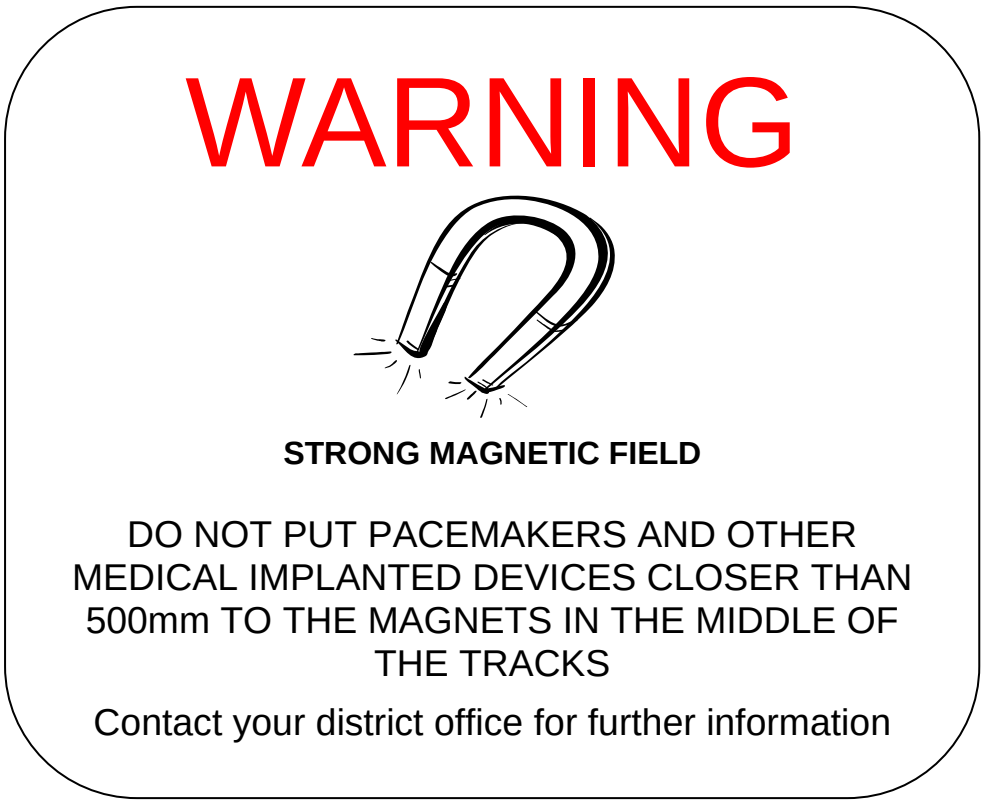

WARNING
STRONG MAGNETIC FIELD
DO NOT PUT PACEMAKERS AND OTHER MEDICAL IMPLANTED DEVICES CLOSER THAN 500mm TO THE MAGNETS IN THE MIDDLE OF THE TRACKS
Contact your district office for further information

*Figure 18- Health Warning Sign*

### C17-4.7 Magnet Installation/Replacement

The magnets are to be replaced by following the guidelines below:

The magnets are permanent magnets and can be damaged by a strong impact, such as a hammer blow or by being dropped onto a hard surface.

### C17-4.7.1 Placement

It is important to note that the following dimensions are specified for installation:

| | | |
|---|---|---|
| Location of centreline of magnet between rails | Track Centre | ± 10mm |
| Spacing between pairs of magnets | 10 metres | ± 500mm |
| Spacing between magnets in a pair | 1800mm | ± 200mm |
| Top of magnet | 10mm below Rail level | - 0 + 10mm |

### C17-4.7.2 Mounting

Sleeper kits, containing mounting plates, spacers, bolts and washers are supplied for different rail size and sleeper type.

To determine the required number of installation components, it is necessary to establish the number and type of magnet installations (timber or concrete sleeper).

### Concrete Sleepers

Mounting on concrete sleepers requires a 40mm thick mounting plate secured to the sleeper with epoxy adhesive. (Use Araldite 2014 (AW 139/XB 5323 two component epoxy paste adhesive or equivalent). The mounting plate has two 20mm tapped threads for securing the spacers and magnet to the mounting plate (See Figure 23).

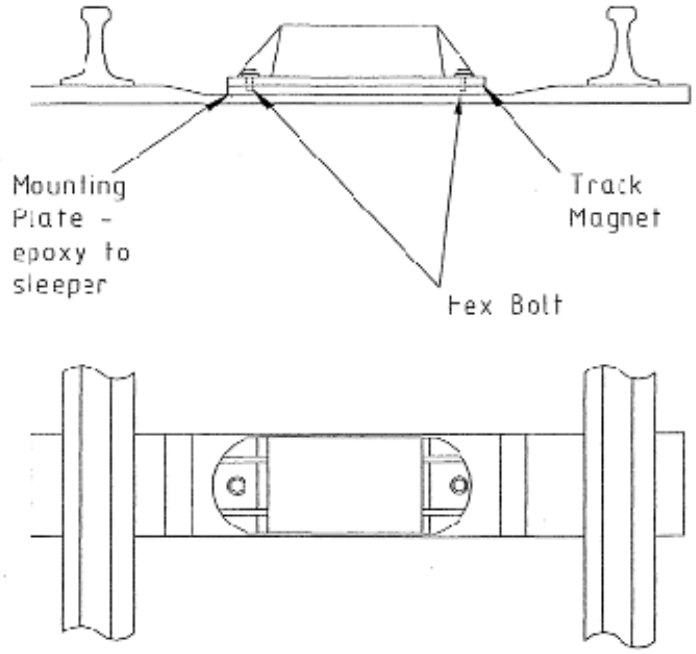



*Figure 19— Magnet installed on concrete sleeper*

### Timber Sleepers

The most common method currently used for attaching the magnets to a timber sleeper is a large flat washer, a 12mm spring washer and a 12mm coach screw.

Note: Coach screw length = spacer depth + 40mm Mounting plate + 45mm embedment in timber.

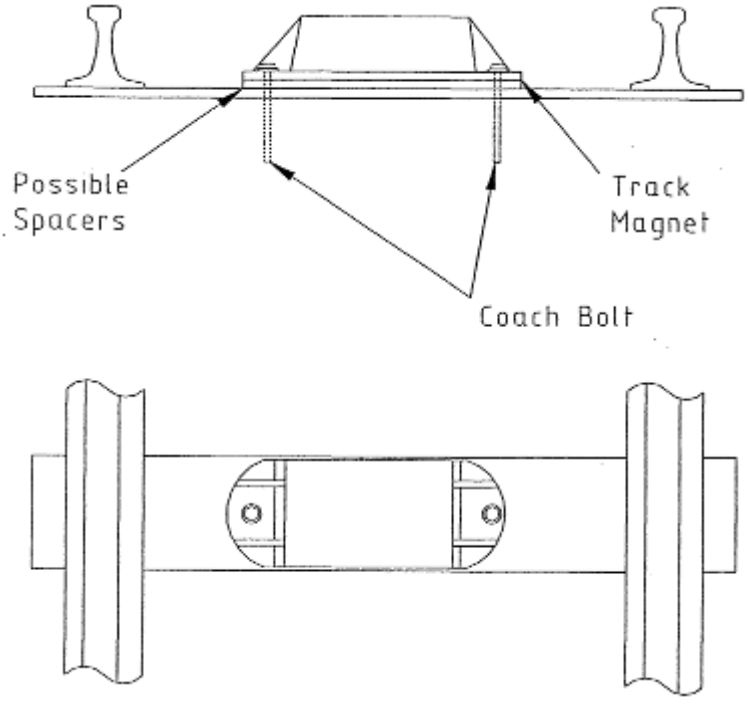



*Figure 20- Magnet installed on timber sleeper*

### C17-4.7.3 Height Adjustments

Use appropriate thickness spacers to set and maintain the height of the top of the track magnet within the tolerances detailed in Section C17-4.7.1.

Additional reference information is provided as follows:

- Bombardier Transportation Track Magnet Installation Guide (Appendix 1).
- Drawing of North & South Pole Magnet (Appendix 2).

## C17-4.8 Spares

1. Two pair of both the North (yellow) and South pole (blue) magnets are to be held at the Main Warehouse at Clyde. One replacement sign of each type should also be available.

2. Spare magnets and sleeper kits (epoxy, mounting plates, spacers, bolts and washers) are available from:

   Fischer Industries Pty Ltd
   23 Dickson Avenue,
   Artarmon, NSW 2064
   Ph: (02) 94360611 and Fax: (02) 9439 2435

3. Signs are available from:-

   Michael Doherty Signs
   5 Dyson Place,
   Moss Vale, NSW
   Ph (02) 4869 1133 and Fax: (02) 4869 1771

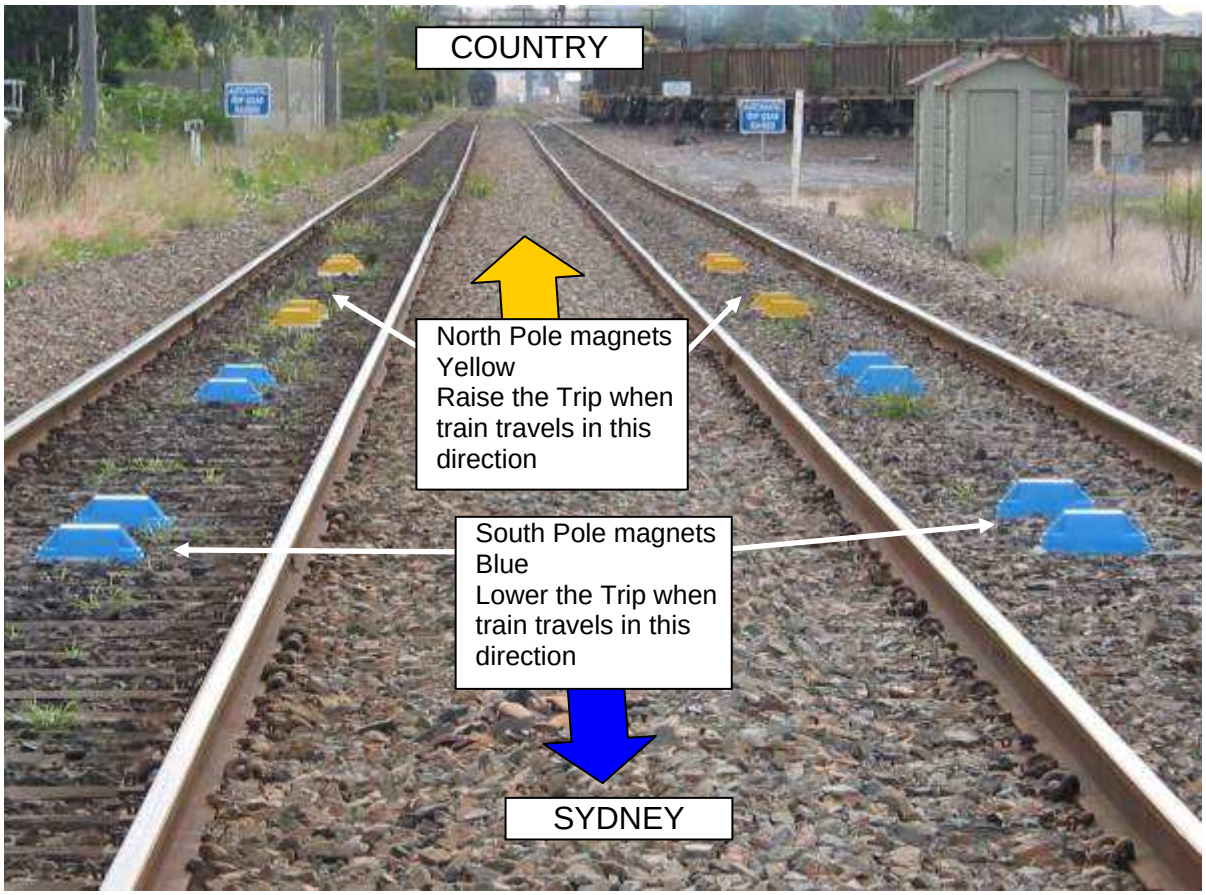
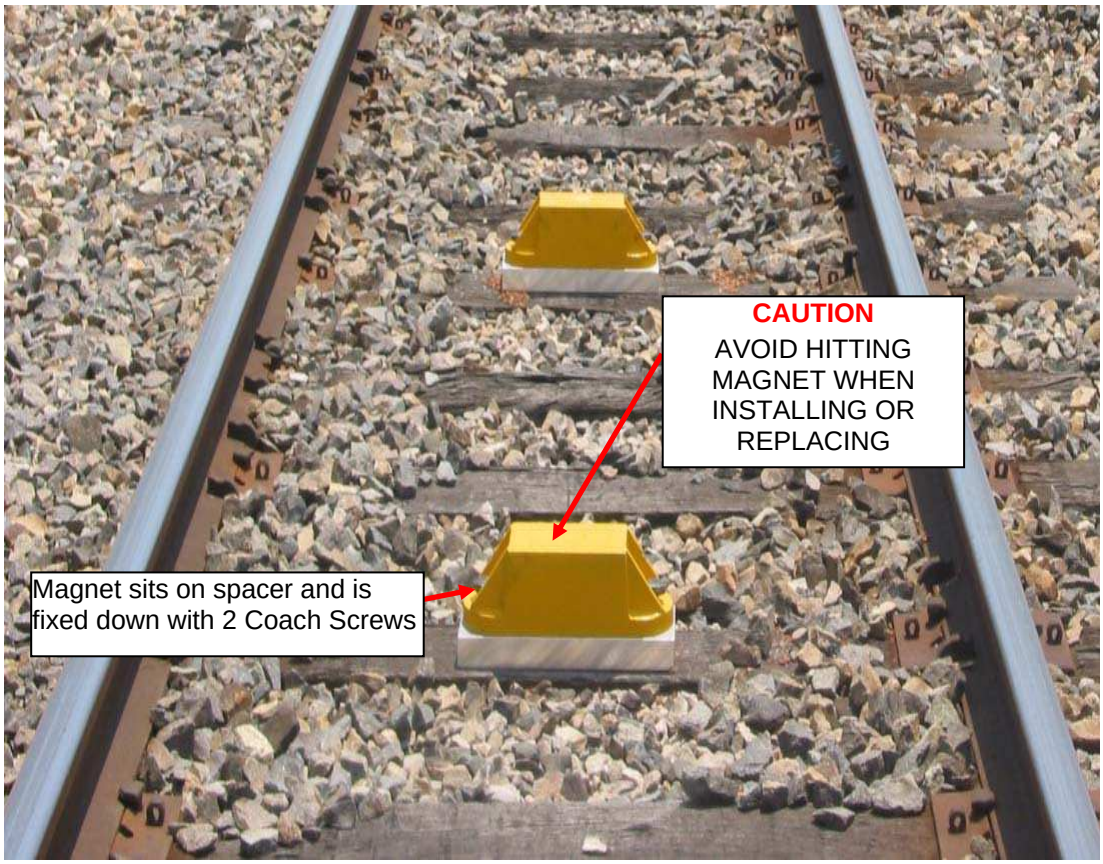
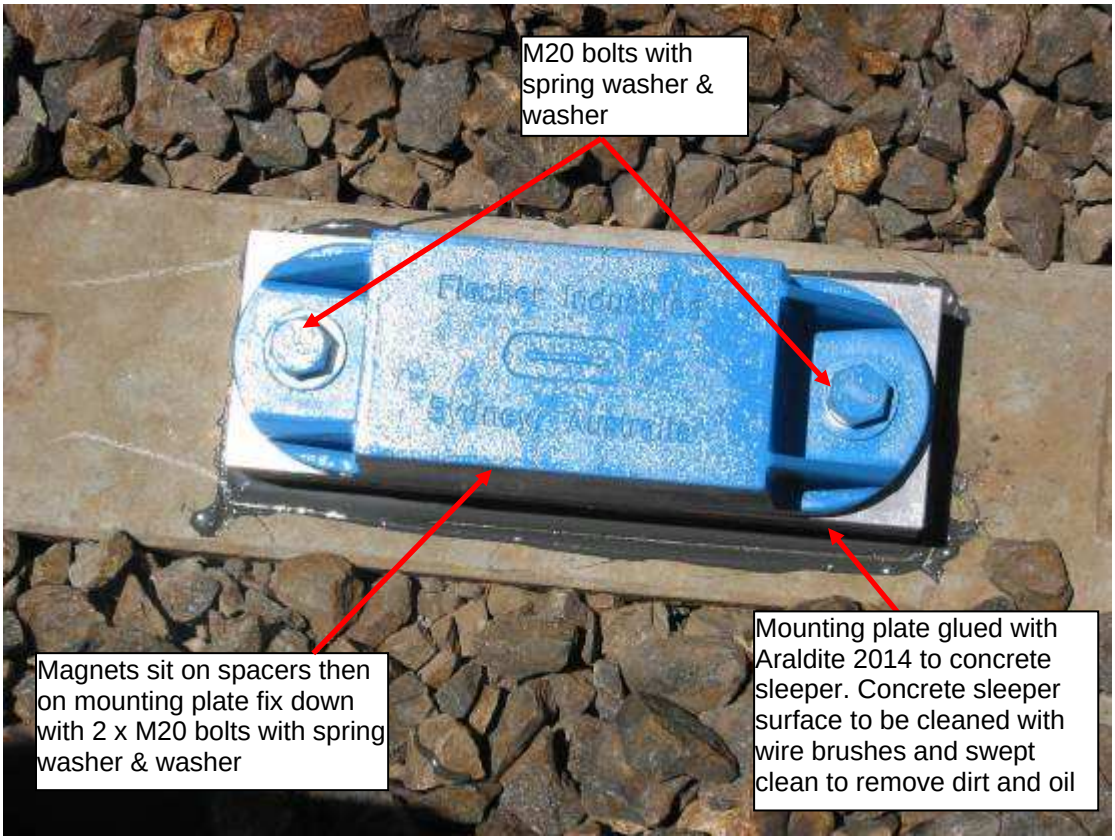



*Figure 21: Complete Trip Magnet Assembly*


CAUTION
AVOID HITTING MAGNET WHEN INSTALLING OR REPLACING
Magnet sits on spacer and is fixed down with 2 Coach Screws


M20 bolts with spring washer & washer
Magnets sit on spacers then on mounting plate fix down with 2 x M20 bolts with spring washer & washer
Mounting plate glued with Araldite 2014 to concrete sleeper. Concrete sleeper surface to be cleaned with wire brushes and swept clean to remove dirt and oil

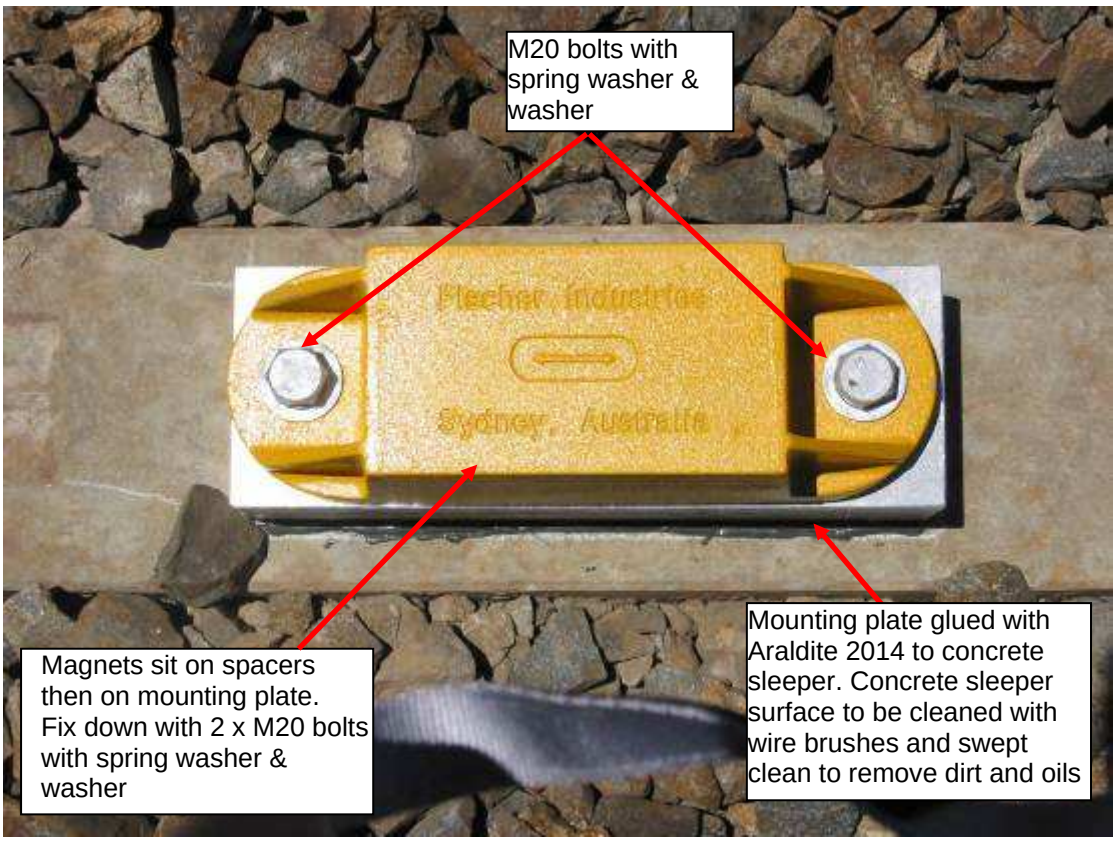

M20 bolts with spring washer & washer
Magnets sit on spacers then on mounting plate. Fix down with 2 x M20 bolts with spring washer & washer
Mounting plate glued with Araldite 2014 to concrete sleeper. Concrete sleeper surface to be cleaned with wire brushes and swept clean to remove dirt and oils

*Figure 24: North Magnet assembly on Concrete sleeper*

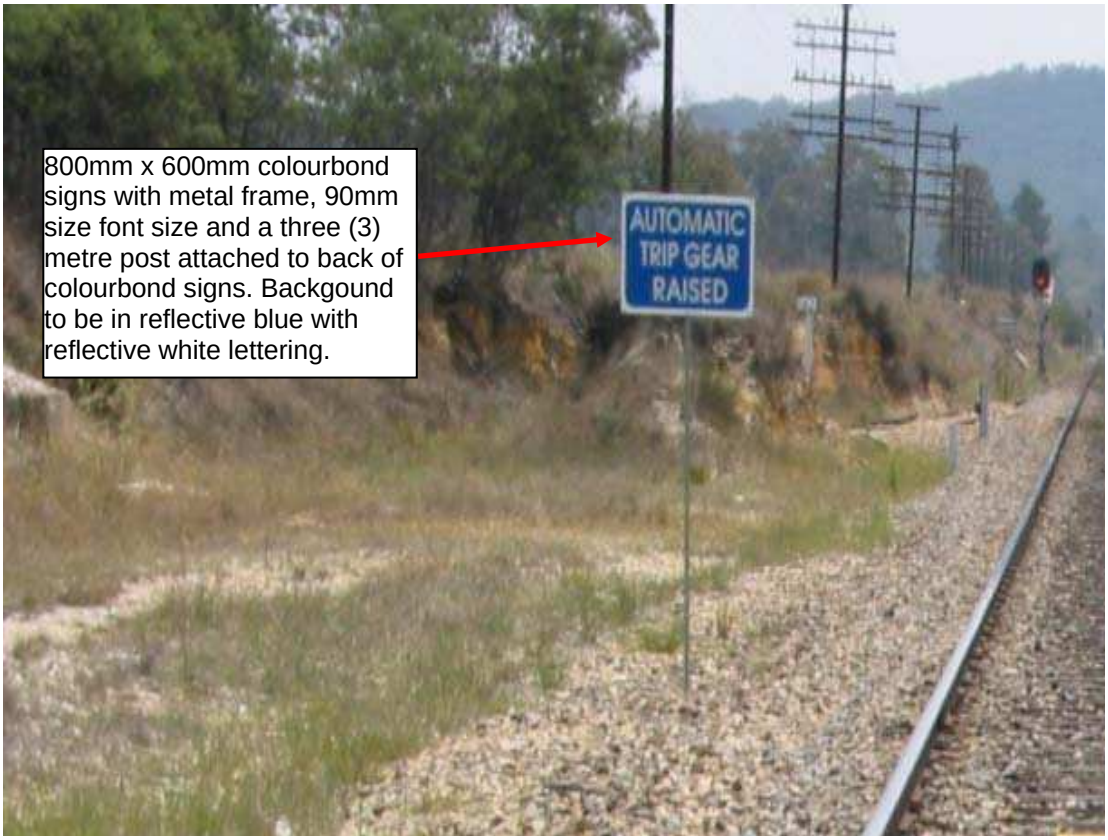

800mm x 600mm colourbond signs with metal frame, 90mm size font size and a three (3) metre post attached to back of colourbond signs. Backgound to be in reflective blue with reflective white lettering.
AUTOMATIC TRIP GEAR RAISED

*Figure 25: Signage used when Automatic trip gear is raised*

800mm x 600mm colourbond signs with metal frame, 90mm size font size and a three (3) metre post attached to back of colourbond signs. Background to be in reflective blue with reflective white lettering.
AUTOMATIC
TRIP GEAR
LOWERED

*Figure 26: Identifies signage used when Automatic trip gear is lowered*

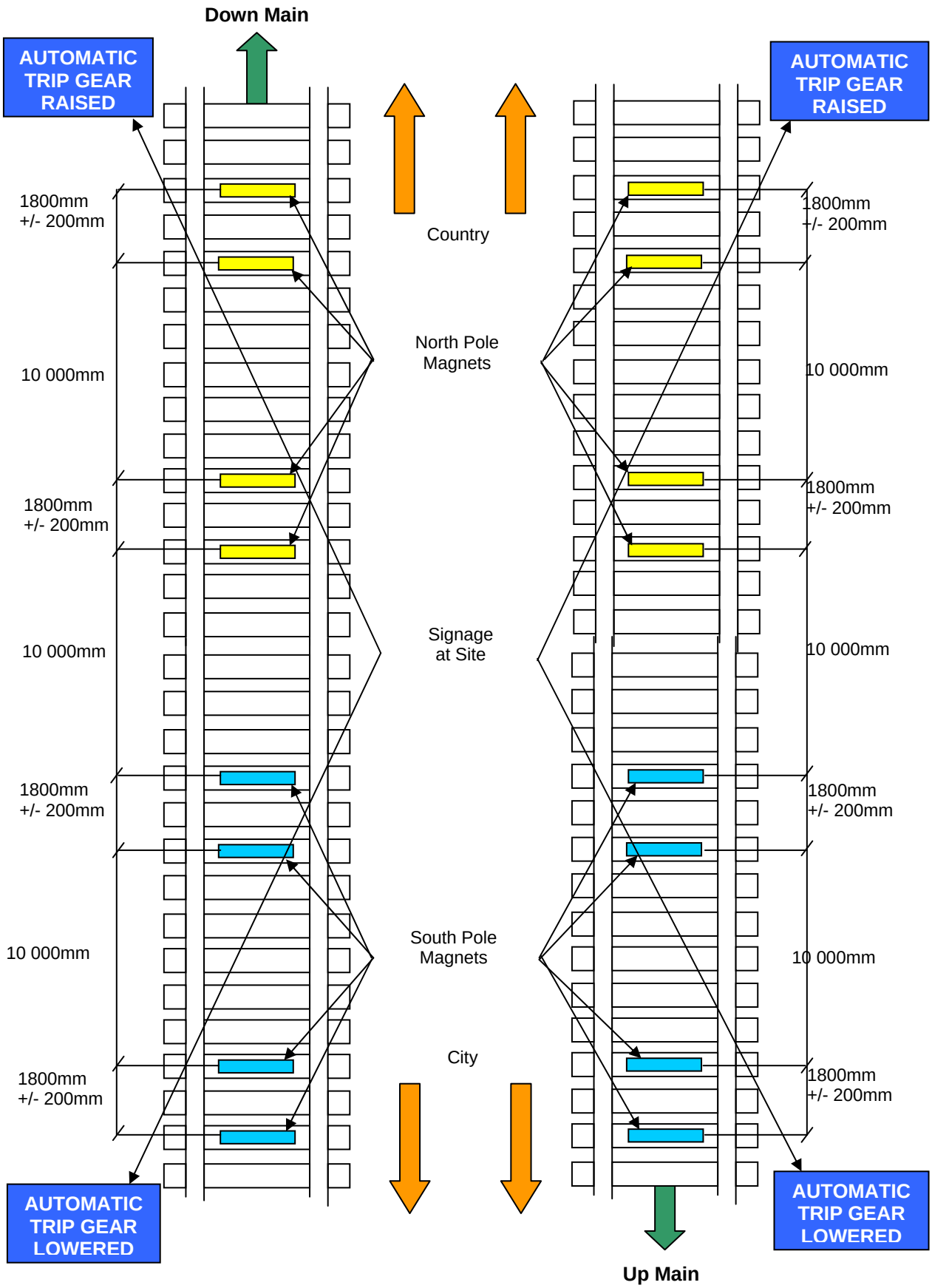



*Figure 27– Track Magnet and Sign Location*

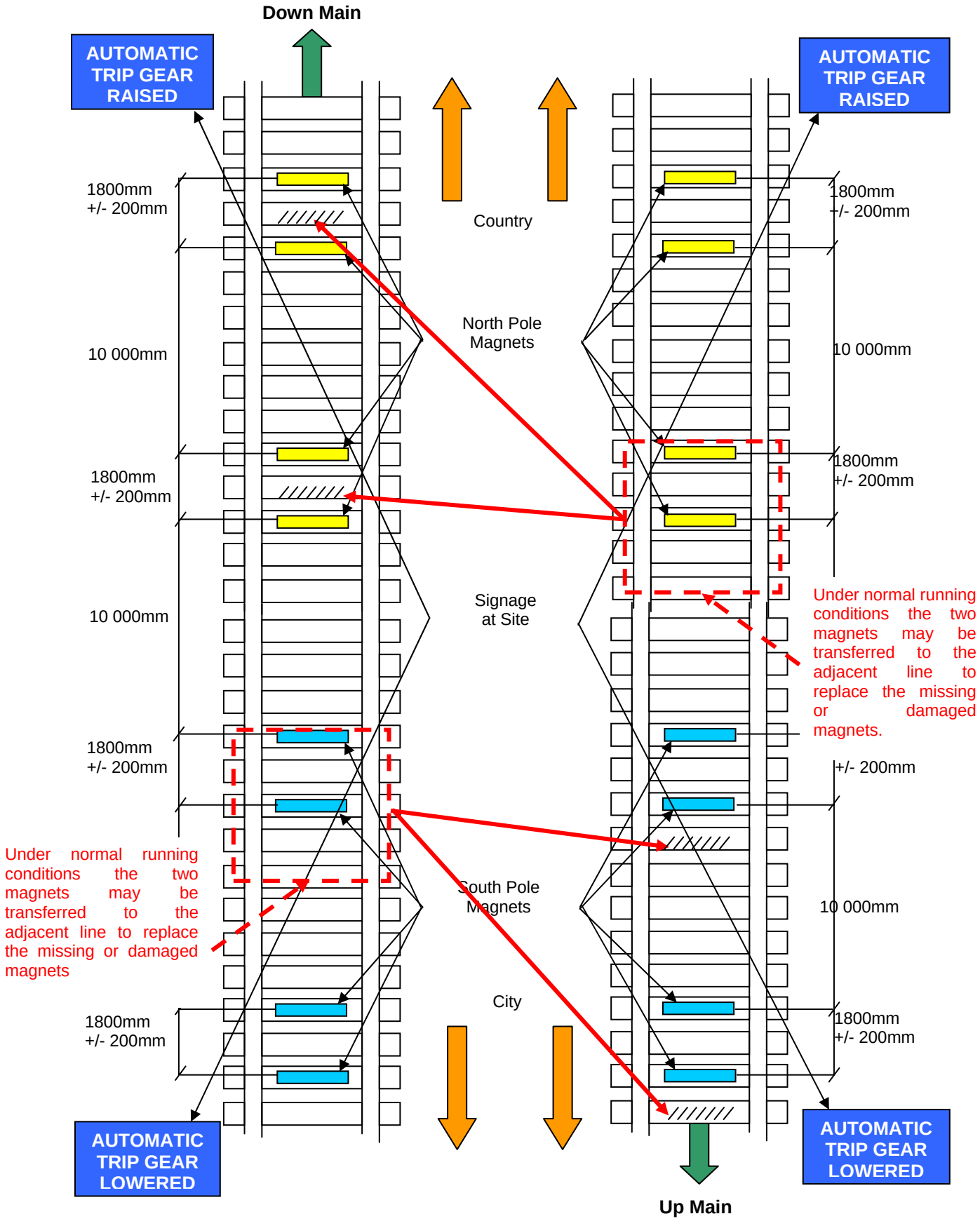

Down Main
AUTOMATIC TRIP GEAR RAISED
AUTOMATIC TRIP GEAR RAISED
1800mm +/- 200mm
10 000mm
1800mm +/- 200mm
10 000mm
1800mm +/- 200mm
Country
North Pole Magnets
Signage at Site
South Pole Magnets
City
1800mm +/- 200mm
10 000mm
1800mm +/- 200mm
1800mm +/- 200mm
Under normal running conditions the two magnets may be transferred to the adjacent line to replace the missing or damaged magnets.
Under normal running conditions the two magnets may be transferred to the adjacent line to replace the missing or damaged magnets
AUTOMATIC TRIP GEAR LOWERED
AUTOMATIC TRIP GEAR LOWERED
Up Main

*Figure 28– Alternative Emergency Magnet Arrangement*

# Appendix 1 Track Magnet Installation Guide

Date: 18-10-02
Authors: Adam Coltman, Martin Pink

BOMBARDIER
TRANSPORTATION

## 1. Track Magnet Installation Guide

## 2. Introduction

This document is a guide for installing track magnets for the XPT and Xplorer Tripcock contracts.

This document is only a guide. It is not a procedure and must not be used as either a procedure or a specification.

### *1.2 Overview*

The proposed automatic tripcock system requires track magnets to be installed at the boundaries of the trip gear controlled area.

Magnets are used in pairs or "sets". The system detects two sets of magnets: North – North or South – South.

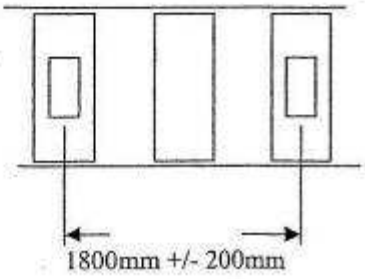
The magnets are supplied and should be fitted in accordance with the Railtrack specification GK/RT0364 "Requirements for the Automatic Warning System".

## 3. 2. Installation

a) The magnet centres must be positioned within 10mm of the track centre line.

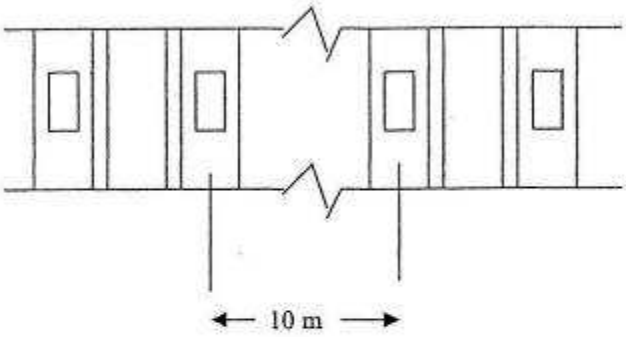
b) The top of the magnet is required to always be 10 mm below top of rail with a tolerance of +10mm / -0mm. Spacers should be fitted to keep the magnet at the correct height for the rail profile and to allow for track wear

c) The magnets are to be spaced 1800mm apart, +/- 200mm, measured from between the centre line of adjacent track magnets.




Page 1 of 4

d) Where there is more than one set (a set is two magnets) to be fitted, there must be a distance of 10 m between the centre line of the nearest magnets with a substantial tolerance.




### *2.1 Mounting.*

Fischer Industries, the OEM, advise that the original design was for dog spikes to be used to attach the magnet to wooden sleepers. The magnets therefore have mounting holes sized at 20mm. The most common method currently used for attaching the magnets is a large flat washer, a 12-mm spring washer and a 12-mm coach screw with a 40-mm engagement in the sleeper.

### *2.2 Height Adjustments*

The following table is included as a guide to the adjustments required for the machining of the railhead and the subsequent loss of height.

**2.2 Height Adjustments Table**

| Rail Head Sleeper max distance | Magnet height | Mounting plate height | Maximum Spacer distance | Max rail head wear | Additional spacer distance | Spacers thickness | No of spacers |
|---|---|---|---|---|---|---|---|
| 217 | 106 | 20 | 91 | 30 | 61 | 10 | 9 |
| 187 | 106 | 20 | 61 | 30 | 31 | 10 | 6 |

### *2.3 Installation Materials Required*

a) To determine the requisite number of installation components, it is necessary to establish the number and type of magnet installations (wood or concrete sleeper).
Note: Magnets must not be installed on steel sleepers.



© Rail Corporation

b) Mounting on concrete sleepers requires a 20mm thick mounting plate secured to the sleeper with epoxy adhesive. The mounting plate has two 12 mm tapped threads for securing the spacers and magnet to the mounting plate.
**Note:** set screw length = (no of spacers x 10mm) + 20mm

c) Mounting on wooden sleepers requires spacer plates, a large flat washer, a 12 mm spring washer and a coach screw of suitable length.
**Note:** coach screw length = (no of spacers x 10mm) + 45mm

NB. The positioning of the magnet top surface wrt rail surface is dimensioned as:

+0mm / –10mm

It is suggested that using 10mm spacers allows adjustment to be readily maintained within the required tolerance for all installations.

## 4. Wooden Sleeper

The following figure indicates how a track magnet should be mounted. This includes spacers to bring the top of the magnet to the height specified.

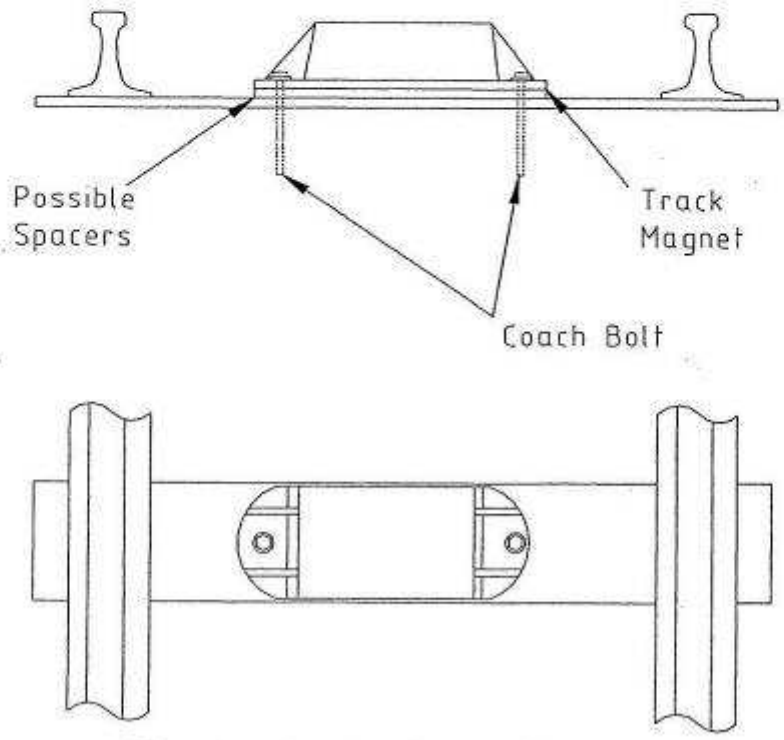



**Figure 1 – Magnet installed to wooden sleeper**

## 5. Concrete Sleeper

The following figure indicates how the track magnet should be mounted to a concrete sleeper. A mounting plate is fitted, fastened with epoxy to the sleeper.

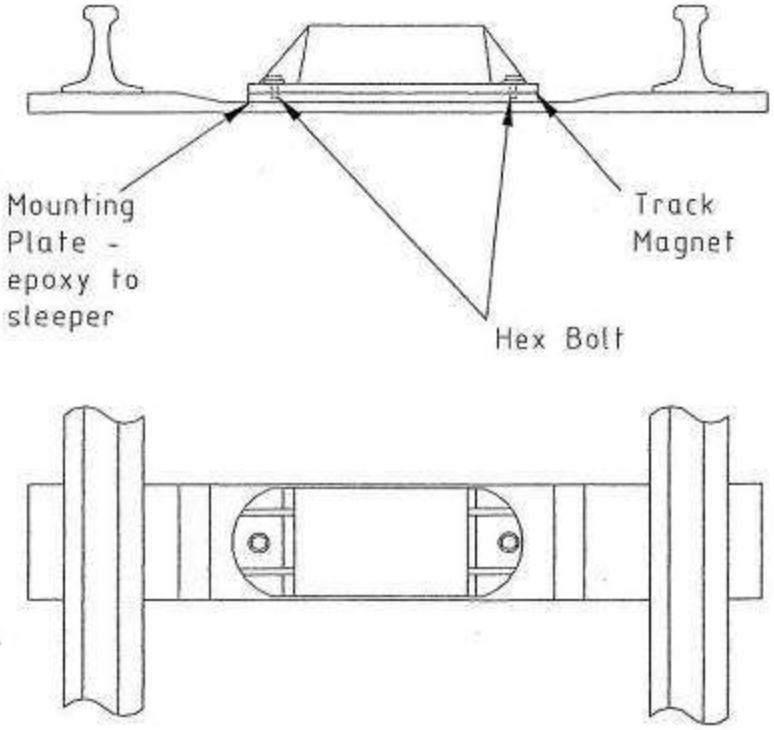
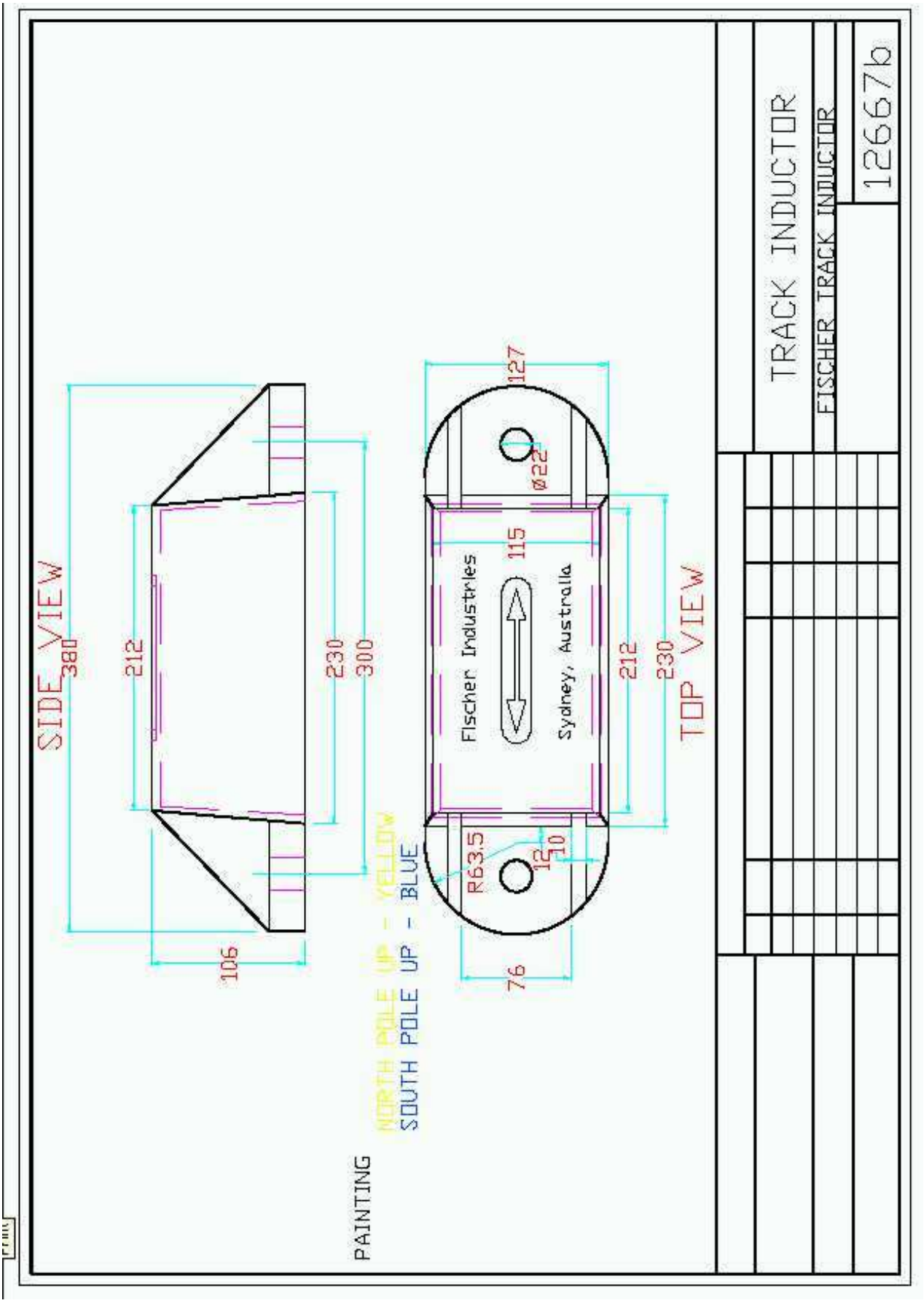



**Figure 2 – Magnet installed to concrete sleeper**

# Appendix 2 Track Inductor Drawing



# Appendix 3 Approved sleeper & fastening products

*The following requirements are extracted from RailCorp Standard* ESC 230

| Common Item Name | Desciption | Standard/ Drawing | Manufacturer/ Supplier |
|---|---|---|---|
| **Non Resilient Fastenings** | | | |
| Dogspike | Spike, track; round shank; 22mm shank dia; 119mm long; forged; steel (dogspike) | AS 1085.8<br>SRA Dwg CV0046205 | |
| Dogspike | Spike, track; round shank; 22mm shank dia; 119mm long; forged; steel (dogspike) | AS 1085.8<br>SRA Dwg CV0046205 | Imported by Westray Eng. |
| Dogspike | Spike, track; round shank; 22mm shank dia; 119mm long; forged; steel (dogspike) | AS 1085.8<br>SRA Dwg CV0046205 | Manufactured by Greg Sewell Forgings |
| Gauge Lockspike | Spike, track, square shank lock type LG19, XS1070 | AS 1085.13 | Pandrol |
| Lockspike | Spike, track, square shank lock type L1, XS1070 | AS 1085.13 | Pandrol |
| Dogscrew | DogScrew 22mm Shouldered; 9mm Thick Flange; Galvanised | Ajax Fasteners Dwg No SRSG19.135 19/10/04 | Ajax / Pandrol |
| Lockscrew | LockScrew 16mm; Galvanised | Ajax Fasteners Dwg No TLSB16.125 10/11/03 | Ajax / Pandrol |
| Screw spike | Spike, track Screw spike; 27mm dia 165mm long. For timber, galvanized to AS 1214 | SRA Dwg 205A-374 (CV 0024139) | |
| Screw spike | Spike, track Screw spike; 24mm dia; 122mm long; galv; For half polymer/concrete sleepers and 90mm nylon insert; galvanized to as 1214 | SRA Dwg 885-067b or Delkor Dwg HSR-602e | Delkor |
| Screw spike | Spike, track Screw spike; 24mm dia; 165mm long; galv; For concrete sleepers; Galvanized to as 1214 | SRA W&W 205a-381b or Delkor Dwg HSR-602d | Delkor |
| Washer, lock | 25mm ID; 46mm OD; 6mm thick; high tension double helical spring type;fe6; Galvanized to as 1214 | Delkor Dwg DSW - 01 | |
| Screw spike | Spike, track Screw spike; 24mm dia | | PRE Manufacturer Jinstar Fastener Co Ltd (Tekway) |
| Screw spike | Spike, track Screw spike; 22mm dia; 150mm long; galv; For timber sleepers; city underground; Galvanized to as 1214 | RSA Consult.<br>Dwg 885-066b | |
| **Resilient Fastenings** | | | |
| Pandrol Clip E series | Rail clip Type e2003; 20 mm dia; 106 mm l; 103 mm w; material XK 9261b; AS 1444; | Pandrol e-21027<br>AS 1085.19 | Pandrol |
| Pandrol Clip E series | Rail clip e1600 series; timber sleeper insulated Joints; painted red; 16 mm dia; 100 mm l; 85 mm w; type e1627 | Pandrol Dwg e16-20002 | Pandrol |

| Common Item Name | Desciption | Standard/ Drawing | Manufacturer/ Supplier |
|---|---|---|---|
| Pandrol Clip E series | Rail clip e1600 series; concrete insulated Joints; painted blue; 16 mm dia; 100 mm l; 85 mm w; type e1629 | Pandrol Dwg e16-20021 | Pandrol |
| Pandrol Clip E series | Rail clip e1829 series;18mm dia;98mm lg;90mm w; 52.5mm 47mm heel;54mm toe; steel; black; (non insulated joints on timber sleepers); | Pandrol e18-20002 | Pandrol |
| Pandrol Clip E series | Rail clip e2079 series; 20mm dia; 106mm l; 102.5 mm w; material XK 9261b; AS 1444 | Pandrol e-21108 | Pandrol |
| Pandrol Zero Longitudinal Restraint (ZLR) Plate | Zero Longitudinal Restraint Plate 41027 to suit 60kg rolled steel sleeper plate and e2079clip. | PMP-41027 | Pandrol |
| Pandrol Zero Longitudinal Restraint (ZLR) Cap | Plate, ZLR Cap 12731 to suit 60kg Delkor Cologne Egg | Pandrol 12730 | Pandrol |
| Fastclip type FC1507 | Pandrol fastclip; type FC1507; silico-manganese spring steel XK9261b with plastic toe insulator | Pandrol FC 1507 and Pandrol 8494 | Pandrol |
| Fastclip type FC1509 | Pandrol fastclip; type FC1509; silico-manganese spring steel XK9261b with toe insulator 10293 (white) and Sidepost Insulator 10292 (white) | Dwg No 10291 | Pandrol |
| Sliding shoulder head | For concrete guard rail sleepers; e-clip fastening (multilok system); to suit 47-60kg rail | Amatek Rocla Dwg SSP 1456 | Pandrol |
| Rail clip, railway | Track; tunnel clips; scheridised; | | Pandrol |
| Rail Clip, Railway | ‘A’ Clip for guardrails, SG Iron | Delkor S.85.745 | Delkor |
| Rail Clip, Railway | Serrated Type ‘A’ Clip | Delkor RAC 02 and RAC-04, Rev A | Delkor |
| **Pads and Insulators** | | | |
| Rail Insulator | Insulator, rail 2 piece: composite insulator in-55058 with a slope of 1 in 45; including cover Plate in-55057;125mm long x 54mm w; 53/60kg rail; | Pandrol In-55061 | |
| Insulator, rail, concrete sleeper | Glass reinforced nylon insulator ;for use with concrete sleeper having pandrol e-clip fastenings;to suit 53/60kg rails | Pandrol In-55088 | Pandrol |
| Rail Insulator | Insulator, rail, concrete sleeper Dual function spacer/insulator for use with 47kg rail in 60kg rail seat;glass reinforced nylon; | | |
| Rail Insulator | G.R.H. Insulator to suit insulated joint Assemblies; 108mm long x 40mm w x 20mm h; 53/60kg rail; | Pandrol In-55186 | Pandrol |
| Rail Insulator side post Fastclip | Pandrol side post insulator type 7551; for use with concrete sleeper having Pandrol Fastclip fastenings | Pandrol 7551 | Pandrol |

| Common Item Name | Desciption | Standard/ Drawing | Manufacturer/ Supplier |
|---|---|---|---|
| Rail Insulator toe Fastclip | Pandrol toe insulator type 8494;for use with concrete sleeper having Pandrol Fastclip fastenings | Pandrol 8494 | Pandrol |
| Rail Insulator | Heavy duty insulator assembly type hda2; 8mm pad x 110mmw; | Pandrol In-55185 | Pandrol |
| Rail pad | Rail pad, railway Fabreeka/rubber;190mm lg x 170mm w x 7mm thk | | |
| Rail pad for use in NSR | Rail pad, railway Studded;rubber;178mm lg x 160mm w x 9.75mm thk;164mm rail base/50kg rail; for concrete sleeper; (transfield product-NSR rail); | | |
| Rail pad | Grooved;HDPE plastic;180mm w x 186mm lg x 7.5mm thk; black; for 53/60kg rail/ concrete sleeper; | | |
| Rail pad | 163mm wide x 180mm long x 7.5mm thick; HDPE.; Used with 53kg and 60kg rails | Pandrol RP-65184C | Pandrol |
| Rail pad | 190mm wide x 190mm long x 5mm thick; H.D.P.E.; Used with 53kg and 60kg rails | Pandrol RP-65026 | Pandrol |
| Rail pad | Pandrol HDPE rail pad; type 8853; for use with concrete sleeper having pandrol e-clip fastenings | Pandrol 8853 | Pandrol |
| Rail pad Fastclip | Pandrol HDPE rail pad;type 9154;for use with concrete sleeper having pandrol fastclip fastenings | Pandrol 9154 | Pandrol |
| **Sleeper plates** | | | |
| Sleeper Plate Screwspike | Screw spike; clip type; 148mm Rail base; 1 in 20 cant; cat no 054 | Pandrol ISP95054 | |
| Sleeper Plate Screwspike | Screw spike; clip type; 146mm rail base; 1 in 20 cant; cat no 086s; | Pandrol isp95086 | |
| Sleeper Plate Clip type | Clip type; 4hole; 146mm rail base; 1 in 20 cant; cat no 486; | Pandrol ISP95486 | |
| Sleeper Plate dogspike | Double shoulder type; 127 mm rail base; 1 in 20 cant; Cat no 430; | BHP 2705 127dstb-df10 | |
| Sleeper Plate Clip type | Screwspike clip type; 148mm rail base; 1 in 20 cant; cat no 098s; bridge type; | Pandrol ISP95098 | |
| Sleeper Plate Clip type | Screwspike clip type; 148mm rail base; Zero cant | Pandrol ISP96485 S | |
| Sleeper Plate Clip type | Screwspike clip type; 148mm rail base; 1 in 20 cant | Pandrol ISP96486 S | |
| Sleeper Plate Clip type | Screwspike clip type; 148mm rail base; 1 : 30 cant | Pandrol ISP96487 S | |
| Sleeper Plate Clip type | Screwspike clip type; 148mm rail base; 1 : 40 cant | Pandrol ISP96488 S | |
| Sleeper Plate Clip type | Screwspike clip type; 148mm rail base; 1 in 80 cant | Pandrol ISP96489 S | |

| Common Item Name | Desciption | Standard/ Drawing | Manufacturer/ Supplier |
|---|---|---|---|
| Sleeper Plate dogspike | Double shoulder type; 146mm rail base; 1 in 20 cant; cat no 420; | BHP 2706 146dstb-df30 | |
| Sleeper Plate Clip type | Clip type; 6hole; 127mm rail base; 1 in 20 cant; | Pandrol isp-95064 | |
| Sleeper Plate Clouth alternative 1 | Clouth alternative 1; 60kg rail; cast Iron-rubber; sound damping, double Shouldered 1:20 cant, end holes at 130mm centres | Delkor RF 0. 02 192 CLA | Delkor |
| Sleeper Plate Clouth alternative 1 | Clouth alternative 1; 60kg rail; cast Iron-rubber; sound dumping, double Shouldered 1:20 cant, end holes at 95mm centres | Delkor RF 0.10.092 CL | Delkor |
| Sleeper Plate Clouth alternative 1 | Clouth alternative 1; 60kg rail; cast Iron-rubber; sound damping, double Shouldered 1:20 cant, side holes | Delkor RF 0.29.092 CLA | Delkor |
| **Timber Sleepers** | | | |
| Timber Sleeper | Sleeper, railway Timber; unbored; 230mm x 130mm x 2440mm ironbark or approved hardwood | AS 3818.2 | |
| Timber Sleeper | Sleeper, railway Timber; 230mm x 130mm x 2440mm lg; bored 47kg/80lb AS "A"; ironbark or approved hardwood | AS 3818.2 | |
| Timber Sleeper | Sleeper, railway Timber; 230mm x 130mm x 2440mm; Bored; 53kg new pattern; Ironbark or approved hardwood | AS 3818.2 | |
| Timber Sleeper | Sleeper, railway Timber; 230mm x 130mm x 2440mm; Bored for Pandrol fastenings | AS 3818.2 | |
| Timber Sleeper | Timber, Dog Screw, new pattern, 230mm x 130mm x 2440mm, Bored | AS 3818.2 | |
| Timber Sleeper | Timber, Dog Screw, Pandrol pattern, 230mm x 130mm x 2440mm, Bored | AS 3818.2 | |
| **Concrete Sleepers** | | | |
| Concrete Sleeper Medium Duty Fastclip (MDFC), 25T | Concrete; Medium duty low profile 25t axle load; Pandrol Fastclip fastening system; mass 232kg | AS 1085.14 | Rocla |
| Concrete Sleeper Medium Duty E-clip (MDEC), 25T | Concrete; Medium duty low profile 25t axle load; Pandrol e2003 fastening system; mass 232kg | AS 1085.14 | Rocla |
| Concrete Sleeper Heavy Duty E-clip (HDEC), 30T | Concrete;Heavy Duty Type 5 30t axle load; Pandrol e-clip fastening system; mass 285kg; | AS 1085.14 | Rocla |
| Concrete Sleeper Heavy Duty Fastclip (HDFC), 30T | Concrete; Heavy Duty 30t axle load; Pandrol Fastclip fastening system; mass 285kg | AS 1085.14 | Rocla |
| Concrete Sleeper Heavy Duty Fastclip (HDFCN) | ARTC Concrete; Heavy Duty Pandrol Fastclip fastening system; SG30/227<br>Restricted conditions of use – requires approval from Chief Engineer Track | AS 1085.14<br>Rocla Dwg 90698 B dated 7/06/2006 | Rocla |

| Common Item Name | Desciption | Standard/ Drawing | Manufacturer/ Supplier |
|---|---|---|---|
| Concrete Sleeper Type 6M 30t E-clip | Concrete; Type 6M 30t axle load; 20 wire Pattern; Pandrol e2003 fastening system; (mass 275kg); | AS 1085.14 | Rocla |
| Concrete Sleeper track circuit Fastclip | Concrete; track circuit sleeper; Medium duty 25t axle load; Pandrol Fastclip fastening | AS 1085.14 | Rocla |
| **Concrete Guardrail Sleepers** | | | |
| Concrete Guardrail Sleeper Heavy Duty E-clip 30T No.1 | Concrete, Heavy Duty E-clip Guardrail sleeper, GR1, 30T axle load, Pandrol E-clip fastening system | AS 1085.14 | |
| Concrete Guardrail Sleeper Heavy Duty E-clip 30T No. 2 to No.6 | Concrete, Heavy Duty E-clip Guardrail sleeper, GR2 to GR6, 30T axle load, Pandrol E-clip fastening system | AS 1085.14 | |
| Concrete Guardrail Sleeper Medium Duty E-clip 25T No. 1 | Concrete, Medium Duty E-clip Guardrail sleeper, GR1, 25T axle load, Pandrol E-clip fastening system | AS 1085.14 | |
| Concrete Guardrail Sleeper Medium Duty E-clip 25T No. 2 to No.6 | Concrete, Medium Duty E-clip Guardrail sleeper, GR2 to GR6, 25T axle load, Pandrol E-clip fastening system | AS 1085.14 | |
| Concrete Guardrail Sleeper Heavy Duty Fastclip 30T No. 1 | Concrete, Heavy Duty Fastclip Guardrail sleeper, GR1, 30T axle load, Pandrol E-clip fastening on guardrail and fastclip on running rail | AS 1085.14 | |
| Concrete Guardrail Sleeper Heavy Duty Fastclip 30T No. 2 to No.6 | Concrete, Heavy Duty Fastclip Guardrail sleeper, GR2 to GR6, 30T axle load, Pandrol E-clip fastening on guardrail and fastclip on running rail | AS 1085.14 | |
| Concrete Guardrail Sleeper Medium Duty Fastclip 25T No. 1 | Concrete, Medium Duty Fastclip Guardrail sleeper, GR1, 25T axle load, Pandrol E-clip fastening on guardrail and fastclip on running rail | AS 1085.14 | |
| Concrete Guardrail Sleeper Medium Duty Fastclip 25T No. 2 to No.6 | Concrete, Medium Duty Fastclip Guardrail sleeper, GR2, 25T axle load, Pandrol E-clip fastening on guardrail and fastclip on running rail | AS 1085.14 | |
| Concrete Guardrail Sleeper Heavy Duty Fastclip 30T | Concrete, Heavy Duty Fastclip Guardrail sleeper, 30T axle load, Pandrol E-clip fastenings with cast in pandrol shoulders on guardrail and Fastclips on running rail | AS 1085.14 and drawing 785-568 & 785-569 | |

| Common Item Name | Desciption | Standard/ Drawing | Manufacturer/ Supplier |
|---|---|---|---|
| Concrete Guardrail Sleeper<br>Heavy Duty E-clip 30T | Concrete, Heavy Duty Fastclip Guardrail sleeper, 30T axle load, Pandrol E-clip fastenings with cast in pandrol shoulders on guardrail and Pandrol E-clip fastenings on running rail | AS 1085.14 and drawing 785-568 & 785-569 | |
| Concrete bearer | Concrete bearer, FLAT 1, 30T, 8 ferrules cast in for cant reducing sleeper plates | AS 1085.14 and drawing 785 576 | |
| Concrete Guardrail Bearer | Concrete Guardrail Bearer, Type AGR1 for “Alternative 1” sleeper plates under running rail, ‘A’ clips hold the guardrail<br>Ordinary AGR1 guardrail sleeper and no. 1 in termination set | AS 1085.14 and drawings 785 030 and 785 031 | |
| Concrete Guardrail Bearer | Concrete Guardrail Bearer, Type AGR2 to AGR7 for “Alternative 1” sleeper plates under running rail | AS 1085.14 and drawings 785 030 and 785 031 | |
| **Polymer Concrete Half Sleepers** | | | |
| Polymer Concrete Half Sleepers | | RailCorp drawings | ACO Polycrete Pty Ltd |

# Appendix 4 Approved sleeper repair processes

*The following requirements are extracted from RailCorp Standard ESC 220*

| Repair Item | Description | Standard/ Drawing | Manufacturer/ Supplier |
|---|---|---|---|
| Pandrol Cast in shoulders | Epoxy concrete repair of damaged concrete shoulders | As detailed in Chapter 14 | Pandrol |
| Pandrol Fastclip shoulders | Welded repair of Fastclip cast-in shoulder components | As detailed in Chapter 14 | Pandrol |

# Appendix 5 Non-Conformance Report

# Non-Conformance Report

**NCR No:** _____ **Date:** _____

## 1. Non-Conformance Description

*Send to: Track Service/Supply Contracts Manager/ Logistics*

Business Unit: _____ Manager/Supervisor: _____

Part Description: _____ Supplier: _____

Part No: _____ Supplier Contact Name: _____

Non-Compliance Details: _____

Inspection/ Tests Conducted: _____

Recommendation: _____

Name/Position: Phone No Date:

## 2. Track Services Assessment

*Send to: Originator / Supply Contracts Manager / Logistics; Issue an CAR*

**A** ☐ Acceptable
**B** ☐ Acceptable with repairs
**C** ☐ Acceptable without repair to Engineering concession
**D** ☐ Not acceptable - Corrective Action Report has been initiated CAR No

Comments: _____

Name/Position: Phone No Date:

## 3. Originator

Action to be taken:
**A** Place in service
**B** Return to Supplier for repair
**C** Quarantine the stock

Comments: _____

Name/Position: _____ Phone No _____ Date: _____

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